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THE

TRANSACTIONS

OF

THE LINNEAN SOCIETY

OF

LONDON.

SECOND SERIES—VOLUME III.

BOTANY.

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1888–94.

Mo. Bot. Garden
1898.

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2nd Ser. BOTANY.] [VOL. III. PART I.

THE
TRANSACTIONS
OF
THE LINNEAN SOCIETY OF LONDON.

THE BOTANY OF THE AFGHAN DELIMITATION COMMISSION.

BY

J. E. T. AITCHISON, M.D., C.I.E., F.R.S., F.L.S.,
NATURALIST ATTACHED TO THE MISSION, AND SECRETARY TO THE SURGEON-GENERAL,
HER MAJESTY'S FORCES, BENGAL.

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April 1888.

Sheet 1.

A MAP TO SHOW
the route traversed by the
NATURALIST
OF THE **AFGHAN DELIMITATION COMMISSION.**
J.E.T. Aitchison. M.D., F.R.S.

SCALE

Fixed encampments shewn thus ■, ◪.
Halting places „ „ ○
Route of Author „ „ -------
Direction of route shown by arrows ⟶
Altitudes in feet above sea level 1,420

10 0 10 20 30 40 50 60 Statute Miles
63°
65°
32°
30°
63° Long. E. of Greenwich.
PERSIA
AFGHANISTAN
BALUCHISTAN
Desert Country
Harut
River
Zagin 1,920
King
Kin 1,520
Kushk-rud 1,480
Jowain (Lash-jowain) 1,420
Permanent Lake
Hamun
Takht-i-rustum 1,280. 1. NOV.
Khuspas Rud
Rud-i-Khor
Rud-i-Shor
Mak-karra-habil 1,290
Ibrahim-abad 1,300
Dé-doda (Deh-dadeh) 1,300
Dé-Kamran 1,400
Padda Sultan 1,440
Kalifat
Nasirabad 1770
Chakr-burja 1,490
Koh-haja (Khaja) 1,500
Rudbar 21. OCT. 1,510
Lundi
18.19 OCT. 1884
Hadj-ali (Khwaja-ali) 1,550
Helmand R.
Rud-i-Marjo
Girishk 3,641
Arghandab R.
Tardak R.
KANDAHAR 3,350
Arghastan R.
Spangaoli
21. SEP. 84.
QUETTA 5,604
Gobrak
Chaman
Pang-pai
Khanak
Gar-mushki
Sukaluk
Gal-i-cha 3,110
Robat
Mannu (Mamu) 4,110
Roz-dan (Muzh-dan) 4,010
Salian 3,890
Sha-Ismail 3,860
Safia 3,370
Kuchen
Shorakin
Samuli
Barapchan
Gurgarok
Kila Kurd
Duganan
Chaghai
Mekh-i-Rustam or Pulchota
Yagi
Thal
65°
Gaz-i-cha 2,680
Kani 2,700
Zaru 2,780
Omar-Sha 2,840
1.2. OCT. Band 2,960
Sanduri
Nushki
Kaisar
Baghok
Jabar
Muhabbat
KALAT 6,783
Stanford's Geog. Estab.

MESHED 3,100 6 JULY-15 SEPT.
Robat-Turúkh
Sharifabad
Sang-bast
Farrah-gird
Robat-i-Safed
Faréh-man
Kalanderabad
Kishmatabad
Karéz-badak 19 JULY
Khairabad
Abdullabad
Langar
Maimadabad
Turbat-i-Haidri 5-9 SEP.
Turbat-i-Shaikh-Jami 11 JUNE-21 JULY
Hauz-i-safed
Nasarabad
Bézd 16-19 JUNE 85
Sangan
PERSIA
Malkat
KHORASAN
Salami
Rui Khauf 25-31 AUGUST
Madrassa
Sangun
Khal-i-Khurdian
Burj-i-Ayubi
Musabad
Robat-i-turk
Do-chah-i-Ibrahim Khan 18 AUG
RUSSIAN TURKESTAN
BADGHIS
AFGHANISTAN
Hari Rud
Zulfikar Tower
Karéz Ilias 16 MAY
Chil-gazi
Sim-kuh 18-19 MAY
Kambao Pass
Kambao-burj 3 MAY
GULRAN (New Fort) 24 FEB.
GULRAN (Old Fort) 15 MAR.
14 MAY Kumani 2,070
30 APRIL
Gal-i-cha 29 APR.
Ao Safed
Asia Déh
Karo-bagh
Tut-i-chi
Aftao 1 DEC (Hafta)
24 JULY Rud-i-Rabask
Toman Agha 2,180
Buniad-khan
Chashma Sabz 26 NOV. 84
Karez
Paropamisus Mts.
Siah Bubuk
Paropamisus Range
Kohtal Sangi
Kalla-i-dast Dargarri
Kafir Kalla
KHUSAN 18-25 NOV. 1,950
TIRPHUL 2,100 4 APRIL
Bridge
Robat-i-Kalcha
Shabad
Roznak
Shékewan
Dana-i-sanjiti
28 MAY, 3 JUNE Chinkilok
Ghorian 30 JULY
Zindijan 2,270
HERAT 3,100
Hari Rud
Cha-dlermu
Kishmaru
Puza-gish
Mt. Do-shakh
Kiliki 8-16 AUGUST
14 NOV 84. Pahir (Parah) 3,450
Gaz-i-cha (Gaz-ak-cha) 3,500
Sher Baksh 3,620
Ser-Mandel 3,210
Karez-dasht 3,420
Sang-bar 2,300
Anar-darra 7 NOV. 84
Zagin 6-7 NOV. 1,920
Harut River
Kushk R.
Ab-i-goshah
Kalla-i-maur
Chaman-i-béd
Islim
23 FEB
Maghur R.
Kushk R.
Kushk
Kara-kainta (Kara Ghaitu) 4,300
Kolari R.
Tutounda
Padda (Padda-poj)
Karéz-darra
Ab-i-kumarra
Ab-i-shora
Karshu R.
Tor-Shakh
Morghab R.
Mara-chak
Karaol-khana 16 FEB
Bala Morghab
KALLA-BALA-MORGHAB 1,330 14 DEC. 84 TO 15 FEB. 85
Marjan
Tirband-i-Turkistan
61°
63°
65°
36°
34°
Kambao-burj
61°30'
45'
62°
GULRAN (New Fort) 2,240 24 FEB.
Shoré-kultegan 4 MAY.
Sang Haji 21 MAY.
GULRAN (Old Fort) 15 MAR.
34°45'
Ao Safed
Tut-i-chi 2,850
Asia déh (Asia Déh)
Karo-bagh
Baba Burk
Ao Safed Pass 2 APRIL
Chashma Sabz Pass
Siah Bubuk
Chashma-sabz
24 MAY
Pass
Kohtal Sangi 25.26 MAY
34°30'
SCALE
6 Miles to an Inch.
0 1 2 3 4 5 6
SCALE
10 0 10 20 30 40 50 60 Statute Miles
Fixed encampments shown thus ■, ◪.
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A MAP TO SHOW
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J.E.T. Aitchison, M.D., F.R.S.

TRANSACTIONS

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I. *The Botany of the Afghan Delimitation Commission. By* J. E. T. AITCHISON, *M.D., C.I.E., F.R.S., F.L.S., Naturalist attached to the Mission, and Secretary to the Surgeon-General, Her Majesty's Forces, Bengal.*

(Plates I.-XLVIII., and Two Maps.)

Read 3rd February, 1887.

INTRODUCTION.

THE paper which I have now the honour of laying before you is the result of my botanical investigations and collections made while I was attached to the Afghan Delimitation Commission during the years 1884 and 1885.

My collections amount to about 800 species and some 10,000 specimens. Of these nearly one hundred are probably * new to science, and, as may be seen from this Report, I have been able to accumulate much interesting matter in relation to products, and to trace several to the plants yielding them. The difficulties I have had to overcome in obtaining the material for the information I now lay before you were on this occasion very great.

I purpose dividing my paper so as to give the botanical characteristics of the country traversed in accordance with its natural divisions represented by its physical features, viz.:—Northern Baluchistan; the valley of the Helmand, from Hadj-ali to the Hamun; the basin of the Harut river, from the Hamun of the Helmand to Pahir; the valley of the Hari-rud; the Badghis district; Mount Do-shakh; and Khorasan.

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* I say probably, because, in consequence of expecting to have to return to India, the collection has been hurriedly and only partially elaborated.

NORTHERN BALUCHISTAN.

The expedition left the vicinity of Quetta, in the extreme north-east of Baluchistan, on the 22nd of September, 1884, marching westwards almost parallel with its northern boundary, along the edge of and partly across the great desert, to the Helmand river at Hadj-ali. In this part of our journey our marches were very long and accomplished with great rapidity, chiefly during the night, as the days were still very hot. As there were no traces of a road of any sort to direct us we were guided at night by large fires, acting as beacons, and during the day by the marks of a plough which had been taken across the country, making a furrow for this special purpose. The season of the year was against any good collections being made, so that the little I did collect were mere scraps, most of which, however, have been identified by comparison with my subsequent collections.

The physical features of Northern Baluchistan consist of great gravel and clay plains, bordered by ranges of limestone and trap hills, intersected by numerous dry water-courses, and of undulated expanses of sand, which are said to be continuously shifting through the action of wind. Between Kani and Gaz-i-cha we saw the effects of the wind, the sand having been driven up against the face of a precipitous cliff to the height of 300 feet; and the range looked as if it would soon disappear altogether beneath this great shifting sea of sand. There are neither rivers nor streams, the vast drainage of the country being wholly swallowed up in the thirsty gravel beds. In traversing this desert we were informed that water was only to be procured at certain localities; this was no doubt true in the sense that water was only exposed at those localities; but it was evident that with a little trouble it was procurable close to the surface in many more places; for on no occasion was the water found at a greater depth than ten feet, often much less. Luckily the few dilapidated botanical specimens that I was able to collect on this portion of our travels, despatched at Hadj-ali on the Helmand for Kew, arrived safely at their destination, and from them I am able to give the general features of the more permanent or shrubby vegetation of Northern Baluchistan. At this season of the year the little vegetation to be seen may be divided, naturally, into that on the hills and on rock-formations; that on the gravel and clay plains; that of the sand-dunes; and, lastly, that where there was water during the whole year.

The most interesting plants found on the hills and on rock-formations were :—*Stocksia Brahuica*, a thorny shrub or small tree, first collected between Khanak and Panj-pai on the 24th of September, and subsequently more or less frequently as far as the Helmand. In its autumnal garb, when leafless, and covered with its brilliantly coloured inflated fruit, it was very showy. It is called by the natives *Koh-tor*, or the mountain-peach, no doubt from the attractive colouring of the fruit. *Pistacia Terebinthus*, var. *mutica*, was occasionally seen on limestone, occurring in some numbers. This is the only indigenous tree of Baluchistan that grows to any size; several I measured were over nine feet in girth at six feet from the ground; but in height none were over twenty feet. *Zygophyllum atriplicioides*, a shrub from four to six feet in height, with fleshy leaves, bright yellow flowers, and curious winged fruit, was seen everywhere, from the stony bases of the hills into the gravel plains. *Perowskia abrotanoides*, a very attractive Labiata, forming a close bush three to four feet high, was general among the rocks; *Periploca aphylla* and two species of *Ephedra*. *Ephedra pachyclados*? was the common one, being very profuse amongst broken rock, boulders, &c., as well as on the gravel plains. The native name for the *Periploca* and the two species of *Ephedra* is *Hum* or *Huma*, the natives not distinguishing between them. *Tamarix gallica*, as a large shrub, the presence of which in quantity and size would, I think, indicate water at no great depth. Further, *Pteropyrum Aucheri*, *Rhazya stricta*, *Stellaria Lessertii*, *Lactuca orientalis*, *Anabasis* sp., *Pennisetum dichotomum*, *Euphorbia osyridea*, *Astragalus hyrcanus*, *Calligonum comosum*, inhabit this region at the base of the hills, and extend thence over the gravel country.

On the gravel and clay plains the vegetation was extremely sparse and stunted; among the prevailing plants, *Alhagi Camelorum* was generally spread over the country, and in some favoured localities it grew in luxuriance and dense masses, through which it was hard to get our horses to go, owing to its numerous objectionable spines. This shrub is usually from one to two feet in height, occasionally as much as three. The ordinary term here for the plant is "Camel-thorn," as it is one of the chief sources of supply of fodder for these animals. In certain seasons it yields a manna. *Peganum Harmala*, *Sophora mollis*, *Sophora Griffithii*, and two species of *Heliotropium* were more or less frequent; and where saline matter impregnated the soil the following shrubs were often in great luxuriance, *Salsola Kali*, *Salsola arbuscula*, *Salsola fœtida*, and several others, with *Halanthium* sp., *Halocharis sulphurea*, *Haloxylon salicornicum*, and *H. Griffithii*.

On the sand-dunes and between the hillocks formed by the sand-waves vegetation was more general and of stronger growth than one would have expected to find on first seeing this formation. This is no doubt due to the deeper layers of the sand being able to retain moisture, down to which the roots easily penetrate through the soft superstructure. The characteristic shrub, often almost a tree in size, is *Haloxylon Ammodendron*, which is the *Tar-gaz* of Baluchistan, and its smaller branches yield the best camel-fodder of the country, and, unlike the Tamarisks, the camels can live continuously upon it without its impairing their health. In general appearance it resembles light-green Tamarisk, hence its native name; but it is at once distinguishable by its pendulous branches and grey white stems; hence the European name White Tamarisk. Although this shrub is found in all directions, it certainly seems to prefer, and grows in greatest luxuriance on, these sand hills. *Tamarix macrocarpa* and other large shrubby species were common. At Omar-sha, where we encamped on sand hills, there were some trees, probably planted, of *Tamarix articulata* with trunks nine feet in girth and over thirty feet in height, and associated with them were some trees of *Tamarix macrocarpa*, from four to six feet in circumference, evidence of the size this species may attain in a favourable locality. The ordinary native name for the latter is *Kirri*; and this term was equally applied to *T. articulata*, although the two species were recognized as different. *Tamarix articulata*, having no special native name here, leads one to surmise that it is not indigenous in this part of the country. At Zaru, close to our encampment, were some large bushes of *Lycium barbarum,* almost devoid of foliage, but covered with bright red fruit, very like small capsicums. Here we lost several camels from no known cause, though all those found dead were lying near these bushes, and had been eating greedily of the berries. I opened several camels, but the post-mortem showed no symptoms of irritant poisoning, yet there was nothing I could detect in their paunches except the berries. From the camels having died so suddenly I suspected narcotic poisoning, and yet a *Lycium,* although nearly allied to a poisonous genus, is not supposed to be itself poisonous. I carefully examined the whole country round, and there was nothing else they could have eaten of a poisonous nature. The natives declared the *Lycium* was *not* poisonous, and subsequently I often saw camels browsing on this shrub without any ultimate evil effects.

In some localities the sand-dunes were covered with *Euphorbia cheirolepis*; a very elegant species, which still, late though the season was, maintained its green foliage. *Tribulus alatus* covered the tops of the sand-dunes in many places with a sward. *Cyperus pungens* at this season only existed in numerous leafy tufts, and very little of the fruiting heads were obtained, though sufficient for identification. *Convolvulus erinaceus* was not uncommon. Peculiar-looking balls formed of a prickly fruited shrub, *Agrophyllum latifolium,* with few or no leaves were noticed rolling about, driven by the winds hither and thither over the flat clay plains (or *Pat*), occasionally accumulating into heaps. This shrub grows in loose sand, and as it is very leafy it is easily lifted out of its position by the wind and, being driven about, it takes the form of a ball, which is often increased in size by coming in contact with other similar plants. It was soon dubbed "the wanderer;" the natives call it the "spinning-wheel," in allusion to this peculiarity. It was curious to note the condition of the roots of the plants that live in these beds of pure sand; some, like the *Haloxylon,* thrust their roots so deeply into the sand as to anchor themselves in the solid ground beneath; others, like *Euphorbia,* with slight stems, little affected by the wind, do not require to be so firmly fixed, and do not root so deeply; grasses and sedges have their fibrous roots greatly lengthened, and develop a spongy tissue as thick as a goose-quill. These spongy enlargements serve two purposes, one for holding fluid for future requirements, and the other for maintaining the position of the plants, each root acting as an individual anchor. The same plants not growing in this loose sand did not possess this peculiar development of their roots. Indeed all the plants that occupy these sandy dunes have a hard struggle for existence; not only have they much to do to keep themselves in position on account of the wind, but when sand is heaped upon them they have to learn to keep themselves alive under the superimposed weight and at the same time to fight their way through it. Furthermore the sand blown on them during summer is hot and dry, so hot and dry that unless these plants are capable of collecting and maintaining a supply of moisture, they must inevitably perish from drought. On other occasions their surrounding medium may be suddenly removed by wind, leaving them to be blown about with the chance of being utterly destroyed before they can be again partially covered with sand and thus afforded the means for supporting life.

In stream-beds amongst thickets of Tamarisk, where there were perennial streams, as at Kaisar and Mannu, the *Oleander* was met with. It is well known to the natives, and said to be common in such localities all over the country. This shrub was very destructive to camels, especially when it was spread through the Tamarisk thickets, as these animals never seem to learn not to browse on it. The native name is *Jaur*, a corruption of the Persian word for poison. Climbing over these shrubs *Clematis orientalis* was in great luxuriance; and on the shady side of some rocks a variety of *Mentha sylvestris*, growing seven feet high, was common. *Andropogon laniger*, a lemon-scented grass, formed turf in the vicinity of the stream, as also *Juncus maritimus*. *Erianthus Ravennæ*, the *Munj* of the Punjab, was occasionally observed in great clumps. Where the stream spread out into broader shallows, flooding the low land occasionally, *Arundo Donax* occurred together with *Phragmites communis*, forming great beds; the latter, where the water was brackish and the soil saline, was extremely dwarfed, with rigid and sharp-pointed leaves. In the Tamarisk groves a large purple-flowered *Orobanche* was occasionally seen, perfect in form and colour, but dried to a cinder, so that it could not be preserved, as on the slightest touch it crumbled into dust.

The fodder supplied to us for our cattle during our journey consisted of the crushed straw of wheat and barley and of the stems of millet (*Sorghum*). Occasionally, in addition to these, the stems of *Pennisetum dichotomum* were also served out. These stems were from one to three feet in length, resembling miniature bamboos; and thus they were termed in camp. Notwithstanding their hardness, they were greedily eaten by our horses, much to our amusement and wonder. The natives call this grass *Barshonk*, and it grows on the stony formation at the bases of the hills only.

At Gaz-i-cha we encamped in a great meadow of *Eragrostis cynosuroides*, which was here unmixed with any other grass. It was called *Kirthag*, and grew in deep pure sand. Such a locality was looked upon as an oasis of plenty for our cattle, and this particular grass was considered very fattening, though had any of our horse-keepers supplied us with it in India, the result, I fear, would have been a general commotion in the establishment. *Aristida plumosa* is highly valued and an excellent fodder, growing in luxuriance on the sand hills of the desert, where usually no other grass is to be seen. It occurs in small separate tufts, from four to six inches in height, and is called *Mazj*. Sheep are especially fond of it. Several creeping species of *Æluropus*, were often mistaken by members of the mission for *Cynodon Dactylon*, the *Dub* of India. These were profuse, especially on the saline plains. *Cynodon* I did not see in Baluchistan, except at Quetta, where it was in abundance on the sides of irrigation-channels. Between Bozdan, Mannu, and Galicha, from the numerous dry leaves found driven about by the wind, a species of *Ferula* was detected in these gravel plains. After much seeking one leaf was at last discovered attached to a root-stock. On digging this up, there was no doubt, from its general appearance and the odour its fractured surfaces emitted, that it was the root of a species yielding *Asafœtida*. Not a single stem was obtainable, but, from the quantity of leaves seen, the plant must be abundant in this locality. The curious thistle-like umbellifer, *Pycnocycla Aucheriana*, was not rare, chiefly present in stony ground; happily sufficient material was collected for its accurate determination. It produces a yellowish gum-resin, and the root-stock, when employed as fuel, emits a very offensive odour. One specimen only of the rare Crucifer *Cithareloma Lehmanni* was obtained in the desert between Nushki and Sanduri.

Our food for this part of the journey was in part previously stored along the route, the remainder being conveyed by the mission. The grain for our horses was all sent from Quetta; dry fodder, such as crushed straw, was collected from Quetta, Nushki, and Band, and where possible the grasses already alluded to were added to the stores. There was no difficulty with regard to fuel, as throughout all the journey Tamàrisk wood was obtainable, although no doubt in some instances at a considerable distance from our encampments; but smaller fuel, consisting of *Artemisia* &c., was always to be had. It was noticed that the twigs of any of these desert bushes would burn though living; one could never say of them in this condition that they were green, and therefore unfit for fuel. Owing to the rapidity of our movements, and the distance of our encampments from habitations, I saw no cultivation except at Band, and there only the remains of Water-melons and other Cucurbitaceæ, *Sorghum*, cotton, and a little tobacco. It is generally admitted that there is a great scarcity of grain in Baluchistan. The supply might easily be augmented from the Helmand and Sistan by opening up a trade-route from these parts to Baluchistan. This could be accomplished at little expense by building a succession of wells at regular intervals, and a few tall pillars to indicate the route. As regards carriage there would never be any difficulty, as this is a country fully capable of maintaining any number of camels, and, indeed, with them even wheeled transport might be adopted.

VALLEY OF THE HELMAND, FROM HADJ-ALI TO HAMUN.

I regret having to report that the botanical specimens, comprising fully 100 species, collected in the valley of the Helmand from Hadj-ali to the Hamun, as well as those obtained between the Hamun and Pahir, were irretrievably injured by having apparently lain under water for some time. Upon opening the cases at Kew plants and paper were found forming a solid block. The cases had been despatched by caravan from Bala-morghab in January 1885, and only arrived in England in January 1886. A case of birds sent with them was received in almost as bad a plight; the only portions of the collections which escaped injury were the reptiles and insects, preserved in glass bottles in spirits. This loss is a real misfortune, because the greater part of these districts had not previously been visited, so far as is known, by any European. My remarks therefore on the vegetation are consequently very imperfect, and unsupported by authenticated specimens.

The mission encamped on the banks of the Helmand on the 16th of October, 1884. The river, even at this time of the year, had considerable depth and velocity, being fordable at only a few places. The water was said to be at its lowest, but that in February or March it rose from fifteen to twenty feet higher than it then was, and that it had been known to rise as high as thirty feet, doing incalculable injury to the cultivated land over which it flowed. The river here has worn itself a deep channel, similar to the cañons of western North America, closely bordered by somewhat high land, which on either side of the river-bed is in physical formation exactly the same as that between

Quetta and the Helmand, consisting of great gravel and clay plains, with seas of moving sand, bearing a similar scanty vegetation. The drainage from these high plateaus, except that in the immediate vicinity of the Helmand, seemed to be absorbed at once by the soil, owing to its limited amount, due to the small rainfall of this climate; in our route we crossed no tributaries or affluents to the river. There can be no doubt that the level of the bed of the river was once much higher than it is at present, inasmuch as in those parts where the high lands recede, plateaus of alluvial deposit of great extent occur at different levels. On these plateaus stand the ruins of forts, towns, and dwellings, the records of past ages and of a dense population. Looking up from the bed of the river at the escarped ends of the receding plains, they appeared like a range of low hills on either side. We at first marched down the left bank of the river, crossed it at Chakrburja, and then followed its course on the right bank to its Hamun, reaching the Takht-i-Rustam, or throne of Rustam, on the 31st of October. The general appearance of this valley is desolate in the extreme, there being little cultivation and few inhabitants; the feeling of desolation being deepened by the constant sight of masses of clay-built ruins. The ruins extend on both sides of the river, and are situated usually on immense plains of alluvial deposit, now utterly treeless and barren. Without an exception all the edifices were built of clay, moulded into great blocks, or of sun-dried bricks, the walls of immense thickness, the roofs and doorways domed and arched, and all of the same material—conclusive proofs of the absence in those days, as now, of good timber and plentiful fuel. On a more close examination of the structure of the material of which these ruins were built, it was seen that it contained similar fragments of glazed and coloured pottery, glass, and slag as were now found spread over the plains on the alluvial clays, proving without doubt that the earlier inhabitants of this valley had possessed the knowledge requisite for the manufacture of glazed pottery and of glass. In a few instances large fire-burnt bricks lay about the plains, usually associated with great masses of slag. Some of the ruins could be traced to a much later period, from having the basement walls pierced with loopholes for musketry, unless similar structures existed in the days of bow-and-arrow equipment. To the archæologist and antiquarian a study of these relics would prove highly interesting, particularly if he could get the present inhabitants to aid him in his researches. There were still to be seen traces of the great irrigation-works of the past, originally built of the stiff clay soil alone, and which centuries ago had been allowed to go to ruin.

Having given an outline of the physical features of the country, I will now from my notes alone describe the vegetation of this the second stage of our journey. The islands of the river and its low banks, which are annually flooded, are in many places covered with good forests of *Populus euphratica* called *Padda*, the trees varying in size from four to six feet in girth, and up to about twenty-five feet in height. The timber is poor, soft and light, but makes good fuel, and would do well for the construction of rafts. The trees were covered with a large climbing *Apocynum* (?), of which the fruit, called *Shangar*, was eaten in a raw state by the camel-drivers. It was considered excellent fodder for the camels, and was collected for this purpose by their owners. In similar localities a bushy *Tamarix* reaching twelve feet in height, with several tall grasses, reeds,

&c., formed dense thickets, in which hogs were said to abound. As we descended the river the extent of cultivation rapidly increased, owing primarily to the banks of the river being low and allowing of easy irrigation, and secondarily to the greater area of the low land, the higher banks of the river gradually receding much further back. Comparatively speaking, by far the greater amount of land capable of cultivation lies fallow, owing to the paucity of inhabitants. We met a number of people who had been sent by the Afghan ruler to colonize some of the land on this river, but there is room for almost any amount of population. Villages, though never very common, gradually increased in number, and inhabitants became more numerous after we passed Lundi, where I saw the first cultivated mulberry-trees, and heard cock-crowing for the first time, the latter a sure sign of habitations. The chief crops observed were wheat, barley, millet, pulse, tobacco, water-melons and various other Cucurbitaceæ, oil-seed (*Sesamum*), *Carthamus*, and a little cotton. In some localities we saw quantities of crushed straw being stacked for the use of cattle during the winter, whereas in other places the heads of the corn and millet had only been detached, the straw being left; but this might have been due to a want of labour. Some poor specimens of Indian corn were seen; but of this, I was told, very little was ever grown. The amount of cotton produced was not sufficient for the needs of the population, as we saw large numbers of cattle laden with cotton being brought from Persian territory. The people possessed innumerable sheep and goats; the wool of the former goes to Persia; the hair of the latter is employed for local requirements. On cultivated land *Alhagi Camelorum* seemed to spring up like a second crop, after the removal of the wheat or barley, and covered some of the fields so closely that one could scarcely credit that a crop of corn had preceded this wilderness. Here, for the first time, I saw as a weed in fields, and apparently a most troublesome one, *Prosopis Stephaniana*, which, as will be hereafter seen, was met with extending to Bala-morghab in the Badghis, and Meshad in Khorasan. It occurred usually as a low thorny bush, from three to four feet high, but it was occasionally seen fully ten feet in height. The fruit is, scarcely without an exception, attacked by an insect, which, although it does not injure the seed, causes the pod to develop into a bloated, twisted, bright-coloured gall. This gall-affected fruit is collected and employed in dyeing and tanning. The shrub is greedily browsed upon by all cattle. *Capparis spinosa*, as a straggling bush up to six feet in height, and spreading like a bramble, was dotted over the country, especially on land that had once been under cultivation. *Artemisia campestris* and *A. maritima*, *Xanthium strumarium*, *Crozophora tinctoria*, and a *Euphorbia* were common everywhere. The irrigation-channels were lined with *Arundo*, *Phragmites*, &c., and *Cynodon Dactylon* was profuse. Near villages were orchards enclosed within walls, and containing chiefly mulberries, vines, plums, and apricots. A large Tamarisk (*T. articulata*?) was, with the exception of *Populus euphratica*, the only indigenous tree in this country. It was in greatest abundance on our march between Rudbar and Koh-haja, growing solitarily on low mounds, a fact recognized by the inhabitants, who call it the "mound-tamarisk." It grows to a great size; I measured one fifteen feet in circumference at six feet from the ground. The reason why it is always found growing on a mound is due, I believe, to the surrounding soil having been washed away. It is noteworthy that I never saw any young trees of this species, but always old specimens, in some localities forming thin forests and always on mounds. These may be the remains of dense forests, the soil on which the intermediate trees grew, and the trees themselves, having been gradually washed away

Near the Hamun, owing to the land lying so low as to be easily flooded by the river, we traversed immense tracts of the country covered with a dense thicket of a small species of tamarisk, reaching twelve feet in height. Between De-doda and Ibrahim-abad this growth was being burnt down. Two reasous were given for doing this; one that the land was going to be reclaimed for cultivation, and the other that it was to enable natural grasses to grow up for the use of the sheep, of which there were very large flocks in these parts. At Padda-sultan we encamped on low-lying ground, which was covered with a luxuriant bed of succulent grasses, much to the delight of our animals. The chief of these grasses was *Panicum antidotale*, which here grew three feet high, springing from great bush-like, woody rhizomes, covered with a dense woolly soft pubescence, and was associated with *Eragrostis poœoides*, *Helochloa schœnoides*, and a species of *Æluropus*. Creeping amongst them and in great luxuriance was the wild state of *Cucumis Melo*, covered with fruit, none averaging over an inch and a half in length. Whilst young the fruit is pubescent, on ripening perfectly glabrous. These were eaten with avidity both raw and cooked by the camp-followers. I must say that the ripe fruit has a most delicious aroma sufficiently tempting to induce anyone to eat it. Near this we saw a weir laid across the river, to supply water for immense irrigation-works, which are still maintained on its left bank. This weir has to be replaced annually, as during the high floods it is always carried away.

At De-doda *Pluchea caspia* formed dense bushes, from three to four feet in height, giving excellent cover to black partridge. *Solanum nigrum* grew in quantity, and was employed as a pot-herb by the camp-followers. Between Rudbar and Koh-haja I picked up what turned out to be the portion of the stem nearest the root of a species of *Balanophora.* A Baluchi camel-man told me it was well known in his country, where it was called *Labbu*, and that it was collected for feeding camels on. A large *Orobanche* is similarly named and employed for the same purpose. To those likely to traverse Baluchistan it would be as well to note that a large and apparently new species of *Balanophora* exists in those regions. Along this portion of our journey the art of house-building was to be seen in its most primitive forms, from the arched bower of tamarisk-rods, leaving the sides so as to form a sort of open lattice-work, for the free inlet of any passing breeze, the top covered with grasses and *Alhaghi* to give shade, to those built for a colder climate, having the sides filled up with rushwork and soil, or replaced by *natural* bricks, with a flattish roof supported by stems of tamarisk or other like material and covered with matting, boughs, and clay. The form of these structures was chiefly circular, imitating a domed roof as nearly as possible, considering the material employed. It may be desirable so explain what is meant by "*natural bricks*." In one of the first letters Dr. W. H. Russell, the 'Times' correspondent, wrote from India during the mutiny, he spoke of part of the country as "a land producing bricks." On flooded land where clay has been deposited, after the water has evaporated, the clay begins to dry; it then cracks all over into innumerable fissures, some of which divide the deposit into pieces in size and shape resembling roughly made bricks; these pieces, while still damp, are lifted up and employed as bricks. Here I saw entire houses built of them; much of the land we crossed near the Hamun was in this brick-producing stage, and it proved very unsafe ground for our horses. Our encampment at the Takht-i-Rustam was on the margin of the Hamun. By the term Hamun the natives of the district mean any piece of water deep enough to allow tamarisk-shrubs, reeds, bulrushes, and such like to grow. The Helmand terminates by expanding out into a great lake, the margin of which consists of miles of Hamun, or shallow water. This was here bounded by a clay hill called the Takht or throne of Rustam, having a precipitous escarpment facing the lake, which rose to a height of about 150 feet, and from which a fair view of the lake was obtained. The reeds extended into the lake about a mile; beyond was an expanse of clear water covered with numerous flocks of water-fowl. The natives of this part possessed large herds of a small species of black cattle very like Highland *Kyloes*, as well as sheep and goats. In the autumn they grazed in the drier portions of the tamarisk and reed-thickets; and in this cover the natives lived in temporary reed huts, erected for protection for themselves and their cattle from the strong winds which had now begun to be prevalent.

THE BASIN OF THE HARUT RIVER, FROM THE HAMUN OF THE HELMAND TO PAHIR.

We marched from Takht-i-Rustam on the 1st of November, keeping generally to the basin of the Harut river, and reached Pahir on the 13th of the same month. In our first march our route lay almost due north, passing over a series of low hills of gravelly soil and skirting closely a town of considerable importance, called indiscriminately Lash, Lash-jowain, or Jowain. It consists of a number of villages close to each other, and is considered the centre of commerce in these parts. The vegetation in the low hills was much the same as that seen on our journey through parts of Baluchistan. *Ephedra pachyclada*, a low shrub, occurred in great masses, and *Zygophyllum atriplicioides* and numerous Chenopodiaceous shrubs were thinly spread over the country. When we at length descended to a locality with water nearer the surface, the cultivation and vegetation resembled that of the Helmand. *Capparis* was in abundance, with *Prosopis* and *Peganum*. Irrigation-channels were plentiful, and we passed close to miles of ruins; but all appeared of a later date than those seen on the Helmand. In the corner of one of these ruins, partly inhabited, was the first windmill we had yet seen, though of very different construction and appearance to those we are familiar with in England. The portion of the mill that corresponds to the vanes of an English mill consisted of an upright axle, with six or eight vanes applied to it, as in the paddle-wheel of a steamer. This was placed upright on the second story of a house, the upper end working in a beam which crossed between the two side walls continued up to that height. The lower portion of the axle passes through the roof of the building beneath into the millstone on the ground floor; and in many cases it is attached to the upper stone, which revolves with the axle, the lower stone being adjusted so as to bring it into proper contact with the upper by a lever. The axle portion bearing the vanes is enclosed by three walls, the two lateral, as already stated, being carried up to support the upper bearings of the axle, and the third facing the direction of the prevailing wind. In this third wall a slit is cut of a sufficient length and width to allow of the wind passing through to drive the axle by its force on the vanes. Each vane consists of a wooden framework covered over with grass-rope or matting, in appearance very like an ordinary Afghan door. We did not need to be reminded during our last march that we had entered a country of wind, of which these mills are characteristic, and which are employed in grinding the various grains of the country. Water-mills are quite as numerous and, indeed, supersede them wherever water-power is obtainable; but I never saw a single hand-mill. The nomads I found crushing their corn between two stones, a roller and a flat stone. Before reaching our camp, we passed across miles of a loose sandy soil, which was one vast meadow of *Eragrostis cynosuroides* alone, in habit reminding me much of the bent-grass in Scotland. We then rode through the remains of a forest of *Populus euphratica*, the larger trees of which, owing to their depth of root, were still alive; but the smaller were all dead, the water-supply to the forest having been in some way cut off. Beyond Lash-jowain, owing to the season of the year, it was almost impossible to get an idea of what the indigenous vegetation of the country is like. Between Kushk-rud and Kin numerous bushes of *Vitex agnus-castus* occurred in sheltered localities, and where in all likelihood there was water close to the surface. The villages became now much more numerous, and the houses were in good condition, all built of sun-dried bricks, with their roofs in the form of a dome, which gave them a curious beehive appearance. The fact of their all having domed roofs proved the absence of good timber in the country for roofing-purposes. The houses are all built, without exception, opening into a general enclosure, out of which leads a common gateway. As these houses are never built higher than ten or twelve feet, generally below the level of the orchard-walls, a village might be easily passed unnoticed, or its extent greatly underestimated. Some of the best orchards we had as yet seen were met with here, surrounded by high walls, some as much as twenty feet in height, affording the necessary protection from the wind. In those at King I saw trees of apple, quince, apricot, mulberry, and trailing vines, and there were some splendid trees of *Populus euphratica*. Much land around these villages was under cultivation. We saw winter wheat three to four inches in height and some only now being sown; a little cotton, from which the ripe pods were being gathered; and a good deal of a very poor form of our ordinary field-bean, some of which was in blossom. The fields were apparently well irrigated from a *Karez*, which means an underground channel leading towards the required locality from a spring of water tapped at a higher level. Of course under all circumstances as little underground work is carried out as possible. The work is begun by sinking shafts in the required course to the proper depth, the bottom of these shafts being joined by tunnelling through the intermediate pieces of ground. Usually the tunnels are left just as they are dug out; sometimes the lower surface is lined with tiles to minimize the loss of water; but

I never saw any of the tunnels lined with masonry. Beyond this, on all cultivated land, the *Prosopis* of the Helmand and *Capparis spinosa* abound, and are a great nuisance to the cultivator. In our march to Zagin we crossed a great deal of scrub, consisting of a small tamarisk, *Lycium*, and *Vitex*; but there was not an indigenous tree to be seen, and the hills near us looked sterile and bare. In the villages passed through were beans in flower, planted as a margin to cotton-fields, and the orchards were larger in size, containing figs, pomegranates, and jujubes, in addition to the trees already mentioned; and the mulberry was much more extensively grown for feeding silkworms. We saw silk in skeins in quantity as well as being spun, spinning-wheels being noticed on the roofs of all the houses. Our last two marches had brought us into a country of peace, plenty, and prosperity, and the people seemed to be energetic and hard-working. Here I got a specimen of *Fagonia cretica* given to me by Captain Maitland, and close to our encampment at Zagin I observed on the outskirts of the village the remains of a cluster of date-palms, one tree only, however, being in good condition. During our journey one or two specimens of this palm in a young condition were seen at Nushki and Koh-haja, and at Kalifat a few dates, which were said to be the produce of Persia, were for sale in the bazaar. Owing to the severity of the winter, Zagin is the northern limit of the date-palm in this region. On the 7th of November, by keeping along the bed of a water-course, we passed through a range of limestone hills. On both sides of the water-course for fully three miles extended the large town of Anar-darra, a very numerously populated place, surrounded by splendid orchards and gardens, which yielded a fine pomegranate in large quantities; hence its name, meaning the pomegranate-pass. There were also many other good fruits and immense quantities of vegetables, such as carrots, beetroot, onions, &c., as well as green fodder, including clover. I was told opium and tobacco were grown too, all owing to the copious and continuous supply of water and the excellent situation of the town, which is sheltered by the hills. I here saw *Ranunculus aquatilis* still in flower; and the trees noted in the orchards which have not been previously mentioned were the almond, peach, plum, *Elæagnus*, and numerous willows, large trees very like *Salix babylonica*. To these gardens, orchards, and fields the Afghans apply all the manure they possess, none of it being burnt or employed for fuel, as in India. On leaving Anar-darra for Sang-bar we gradually ascended to an altitude of nearly 3000 feet above the sea-level, and entered upon a district much resembling portions of our march through Baluchistan, both with regard to its physical aspect and its vegetation—as here we again came across *Stocksia* covered with fruit, and in addition began to touch upon a new flora. A shrubby *Amygdalus*, the remains of *Eremuri*, a different *Ephedra*, *Cousinia heterophylla*, a bush Composita with oak-like leaves, and various species of *Artemisia*, and a few small trees of the *Rhus* previously collected, the leaves of a tree, probably a species of *Acer*, an *Acanthophyllum*, and several *Astragali* in great hummocks. As we continued our journey, we traversed extensive gravel-plains and plateaus with limestone hills on either side. These plains were covered in some places, as if cultivated, by *Iris sibirica*, the leaves and stems of which lay on the ground like so much straw; and it was difficult, except after careful examination, to believe that we were not riding through ordinary straw, the residue of field-culture. Our marches here were very long and tedious, and the sameness of the sterile treeless plains made them uninteresting. This monotony was, however, occasionally relieved by views of the distant hills, with their picturesque, irregular outlines, and by the great beauty of the sunrises and sunsets. We eagerly looked forward to the first sight we should have of Mount Do-shakh, the most prominent peak, with two points, of a range of hills that divided the watershed of the south from the north, and in turning the eastern flank of which at Pahir we should begin to enter the Hari-rud valley, and probably see Herat in the distance. On the 12th of November we had the most superb view of the Do-shakh range at sunrise from Gaz-i-cha; and near our camp there I saw the first cultivated ash, and with it several willows and *Populus euphratica.* The camp-sutlers brought in for sale some fine specimens of the celebrated *Sarda* melons, besides grapes, pistacio nuts, and raisins; showing that we had at last reached a land overflowing with fruit. On the 13th of November we arrived at Pahir, and there beneath us, at a distance of some 25 miles, lay the city of Herat, its position being chiefly distinguishable by the deep shadows of its numerous orchards and some buildings with tall minarets. From Pahir, a small village at the eastern extremity of the Do-shakh range, and fully 300 feet above the bed of the Hari-rud river, we had a most excellent view of the general aspect of the valley.

The Valley of the Hari-rud.

The portion of the valley of that part of the Hari-rud river with which I am acquainted lies between the village of Shekewan in the south-east, to a little further north than Kumani-besht in the west. This portion of the valley is bounded to the north and east by the Paropamisus range, to the south by the Do-shakh range, and to the west by low ranges of hills, offshoots of the Koh-Bakharaz on the Persian frontier. Its altitude above the sea-level at Shekewan is about 2300 feet, and at Kumani-besht about 2000 feet. The general appearance of the valley in winter, when we first saw it, totally devoid of trees, shrubs, and bushes, led one to speculate as to the probability or otherwise of verdure ever being present. Great was my surprise therefore, when passing over the same ground in summer, to find that a vegetation of marvellous luxuriance had sprung up, constituting a flora distinct from anything I had before seen. Along the banks of the river stretch immense rich alluvial plateaus, which are only partially cultivated by irrigation from the river. The Hari-rud is only fordable from midsummer to the end of December; during the rest of the year all the traffic is conveyed across it over two bridges, one at Herat and the other at Tirphul. I have heard that there are ferry-boats, but I never saw any. The general course of the river, as far as Tirphul, is from east to west; but from this point it makes a wide detour in a north-westerly direction, until it reaches Toman-agha, whence it proceeds almost due north. The chief towns in the valley are Shekewan, Zindijan, Ghorian, Roznak, and Khusan. During early summer, owing to the extent of land under cultivation, as well as to the general fertility of the soil and the presence of the moisture of the spring rains, the valley appears one vast green meadow. The towns just mentioned are not solely inhabited by cultivators of the soil; fully one half of the population are owners of immense flocks of sheep and goats. During summer these semi-nomads disappear with their flocks to the great grazing-grounds of the surrounding country, and only return late in the year to winter their flocks. The cultivation, as it at present exists, is very poor and second-rate, compared with what it might be under a strong and vigorous government, favourably disposed to the agricultural development of the country. The people look and are miserably poor and badly clad; the houses are all more or less in ruins, walls unrepaired, many orchards running to waste, and fields lying fallow. Everywhere signs of decay and poverty were apparent, a great contrast to the state of things found at Lash-jowain. Yet the valley looked capable of maintaining 100,000 inhabitants, were only labour and capital forthcoming to extend the cultivated area by developing and improving the present system of irrigation-works, for without a liberal artificial supply of water at this altitude nothing will grow.

There are no indigenous trees in the valley, except on the islands and low lands of the river, where in some instances dense forests of *Populus euphratica* occur, with several large species of *Tamarix*, as *T. tetragyna*, *T. Pallasii*, *T. tetrandra*, and others, and *Lycium barbarum*, remarkable in early spring for its vivid green foliage. Climbing over them were *Clematis orientalis*, *Cynanchum acutum*, *Asparagus Breslerianus*, and *A. verticillatus*, with *Dodartia orientalis*, which has a very curious, stiff, broom-like habit, beneath. *Erianthus Ravennæ*, *Phragmitis*, and *Arundo* are common: the two latter especially along the embankments of all irrigation-channels. On the receding of the river in early summer it was extraordinary how millions of a small fungus, *Agaricus* (*Naucoria*) *Vervacti* sprang up out of the freshly deposited soil. At Kumani-besht, where the river widens, forming many islands, *Haloxylon Ammodendron* constitutes a great part of the thicket already described, and is here almost a tree, both in height and in girth—what a contrast to the locality in which I first met this shrub, in the sandy dunes of Baluchistan! Its presence here no doubt helps to prove its dependence upon moisture. Cultivation, as already stated, can only be carried out with the aid of irrigation; hence the villages and fields are situated in the vicinity of the river, unless, as at Ghorian, which is at some distance, large irrigation-channels have been opened. The houses of all these villages are built of sun-dried bricks, having, with few exceptions, domed roofs, and there is generally but one door, and in the roof an outlet for smoke, such a thing as a window being unknown. For winter accommodation they are very comfortable, but in summer the heat within them is unbearable; hence all those who can, live out in the open under the cover of black tents, made of goats' hair blanketing fixed on a wooden framework, sufficiently raised to permit of a free passage for air and yet preserve a certain amount of privacy. The orchards are here, as in the Harut valley, surrounded by high walls; a row of mulberry-trees running round the inner side are grown for feeding silkworms. A native, in pointing out these to me, said, "When you see large trees they are no longer employed for this purpose." On my observing that all the trees at that village were large, he admitted the fact, but added, "You know that there is no silk-culture now in comparison to what there has been, owing to the disease among the worms."

In several villages, owing to this disease, silk-culture had been entirely abandoned. For silk-culture the trees are pollarded about four feet from the ground, and at this height the annual shoots are removed. When the trees are large, they give shelter generally to the orchard, and are kept for their fruit, which, although poor in the extreme, is collected and dried in the sun for the purpose of being subsequently ground into flour and made, mixed with ordinary flour, into bread. After seeing the soil on which the mulberries were collected, and that on which they are placed to dry, I never wish to taste another Afghan dried mulberry! There could not be a more prolific source for the propagation of disease. The other orchard-trees were apricots, plums, apples, cherries, quinces, jujubes, *Elæagnus*, and vines. The last are either permitted to climb on the trees in the orchard, or are planted in deep broad trenches, the soil from which is made into a sloping bank with a northern exposure. On the banks the vines are either allowed directly to trail, or are supported on a lattice-work fixed on the slope so as to keep the fruit from coming into contact with the ground.

Occasionally pears, peaches, almonds, pomegranates, and figs are grown in the better class of orchards, where it is very common to see both yellow and red roses. The latter, *R. damascena*, is cultivated for the distillation of rose-water, and *Rubia tinctorum* for its roots as a dye-stuff; and under the trees, *Medicago* and *Trigonella* are usually cultivated for fodder. As garden-crops numerous kinds of vegetables are cultivated, of which the Afghans are extremely fond, and some of them are excellent in quality. Even in England one scarcely expects to see finer beetroot, carrots, turnips, onions, or cabbages than are grown here, besides radishes, tomatos, brinjals, and chillies, which are all fairly good, with numerous pot-herbs. Requiring more care than ordinary field-crops, opium, tobacco, and some oil-seeds are also grown in gardens.

The field-cultivation consists primarily of wheat, which is fairly good; but in some localities it is overgrown with rye, which is an indigenous weed. Barley of two kinds is grown; the finer, and the grain of which is the sweeter and considered fit for human food, is *Hordeum hexastichon*, which is said to take a month longer to ripen than the other. The grain of *Hordeum vulgare* is only considered suitable for horses, &c.; but as it takes much less time to ripen, it is occasionally grown as a second crop; usually there is no such thing as a second crop, in these parts, of any produce.

Only when water can be liberally supplied is *Sorghum*, the greater millet, grown as a crop by itself; it is commonly seen spread at irregular distances in fields of tobacco or of melons. Cotton is grown to some extent, but the staple cannot be compared with that from Turkistan. I should say that water-melons rank next to wheat in value as a food-crop. During two or three months of the hot weather the natives seem to live entirely upon them with a little bread; and they contain so much saccharine matter that in Herat a syrup or sugar is extracted from them. Ordinary melons are cultivated, but in much less quantity than the water-melon, and mixed with them is a great variety of pumpkins and other Cucurbitaceæ. In these melon-fields it is curious to see, either sprinkled thinly through them, or growing in single lines along the outer margin of the fields, the castor-oil plant, cultivated as it was in Griffith's time, for its oil for burning, the inhabitants being still ignorant of its uses as a medicine. The cultivated trees in the vicinity of villages and in orchards are an ash, an elm, the Lombardy poplar, *Pinus halepensis*, and several large willows, and, rarely, the Oriental plane.

I saw *Datura alba* as an introduced weed near dwellings at Khusan. Of *Cannabis sativa* I never saw a single plant, except a little cultivated in Khorasan. The weeds of field-cultivation were *Prosopis, Capparis, Rosa berberifolia*, rye amongst growing wheat only, and in some instances outnumbering the wheat-crop, *Avena fatua, Adonis æstivalis*, which was a much more luxuriant and larger-flowered plant than when it grew in the adjoining plains, *Isatis Boisseriana, Neslia, Sisymbrium, Arenaria holosteoides, Centaurea depressa, Cnicus, Anchsua italica*, a splendid herb when in full blossom, having superb blue flowers, *Orobanche ægyptiaca* in many localities, colouring the melon- and tobacco-fields with its bright purple flowers. In a few places I met with *Cynomorium coccineum*, a blood-red species of the Balanophoreæ, which altogether captivated my Indian followers, who collected portions to take home for purposes of medicine. Here also I found a very handsome new yellow *Centaurea* (*C. plumosa*, Aitch. et Hemsl.).

The indigenous flora of the Hari-rud valley consists of annuals and perennial herbs and shrubs with large root-stocks, bulbous roots, bulbs, or rhizomes—structural developments which enable them to baffle and survive through the extremes of temperature and climate. Umbelliferæ are characteristic of this flora; and many of them are of large dimensions, including *Ferula fœtida* (Asafœtida), *Ferula galbaniflua* (Galbanum), and *Dorema Ammoniacum* (Gum Ammoniacum). In four months these large plants have come and gone; suddenly appearing in the beginning of May, when their root-foliage is fully developed, covering the whole country with a carpet of the richest verdure, they as completely by the end of August have disappeared. If there is anything at all to be seen of them subsequent to this period it consists merely of a few dried stems, with an occasional bunch of ripe fruit. Usually these three plants grow gregariously and unmixed; sometimes, however, the Asafœtida and the Ammoniacum are associated together. Of the Asafœtida, only one plant out of a hundred met with was in flower, and in that state it is remarkable for the cabbage-like head at first thrown up, the flowers being enclosed in the enormous sheathing stipules, of which the stem-leaves almost entirely consist. As development progresses, these are thrown off, and for a short time the flower-head presents the appearance of a large cauliflower. From this period the stem bearing the inflorescence rapidly shoots upwards to a height of from four to five feet, its proportions being singularly massive and pillar-like. The Ammoniacum and Galbanum seem to me to differ from the Asafœtida in throwing up from their perennial roots a flowering stem annually, whereas the Asafœtida after several years' growth throws up a flowering stem and then dies. This view may appear unsound, but the facts that all the plants of the Ammoniacum and Galbanum were seen to be either in flower or in fruit, and that their stems and roots were found to vary greatly as to size, go a long way to support my opinion; but this remains a subject for future investigation.

The Galbanum, from its youngest stage, has a slight tinge of yellow all through its stems and leaves, and there is a general semitransparency about the plant which gives it the appearance of being made of wax. When a great bed of this is in full but young blossom, the sight is a most striking one, the whole plant, at that period of its growth, being of an orange colour. The Ammoniacum is more remarkable for the great expanse of its root-leaves, and the similarity which they present to the same leaves of the Asafœtida, so great, that experts alone could possibly distinguish them. The stems of all these large Umbelliferæ vary from four to five feet in height, and probably that of the Asafœtida is the tallest, and is remarkable for its bamboo-like appearance and its ending in a cluster of flowering peduncles; and that of the Ammoniacum for its enlarged nodes at the base of each stem-leaf. The stem of the Galbanum has no enlarged nodes, and its flowering peduncles originate irregularly along the stem, and are not clustered at the top of the stem. These Umbelliferæ extend both into the Badghis and Khorasan. In the Badghis the greater moisture of the climate, I think, enables the Galbanum to attain its greatest perfection; but wherever they appear they excite attention by their remarkable habit and magnificent appearance.

Zygophyllum atriplicoides, a bush never over four feet in height, is found scattered in a few localities over the country. It is useless as fodder or for fuel. Two species of *Artemisia*, with woody stems, one to two feet in height, cover the country with a thin scrub, and form the chief pasturage on these gravelly plains, and their gnarled root-stocks and stems are excellent fuel. There are numerous Leguminosæ, among which *Eversmannia* is a superb plant, bearing a profusion of purplish rose-coloured flowers. *Acanthophyllum squarrosum* was in abundance and a very variable species, including, in my opinion, three of Boissier's. It occurs with several species of *Acantholimon*, *Statice*, and *Astragalus* in the form of great spheroid tufts, cushions, and hummocks, covered with numerous blossoms, simulating artificial bouquets of greater or less size, the favourite morsels of camels, sheep, and goats. In some instances the sheep and goats cannot browse them, owing to the spines being in advance of the flowers—an instance of fixed bayonets. Associated with them are numerous species of *Cousinia*, among which *C. Deserti* came much under our notice, owing to its holly-like leaves, and *C. heterophylla*, with its grey oak-like leaves. Other prominent plants were *Gaillonia*, *Ephedra*, and *Eurotia*. In early spring *Tulipa montana* gave a rich colouring to the whole plain, of every shade from bright crimson, crimson and yellow, to pure yellow, and *Iris songarica* scattered sparsely in large clumps, continued flowering well on into autumn, was remarkable for its handsome mauve flowers. A species of *Helicophyllum* was also profuse, at once attracting attention in early spring by its deeply purple-coloured spathes. Annuals were in abundance; most of these are spring flowers, and grow, many of them, in such profusion, covering large areas, that they colour the country with their varied hues—among them *Papaver*, *Glaucium*, *Rœmeria*, *Chorispora*, *Malcolmia*, *Sisymbrium*, *Goldbachia*, *Isatis*, and one species of *Ranunculus*.

One of the chief grasses, most prolific in early summer, and covering the ground everywhere, was *Poa bulbosa*, growing from ten to eighteen inches in height; in these parts it might be collected with the greatest ease as fodder sufficient to supply large numbers of cattle. *Stipa pennata* is one of the few grasses which extends to the sterile portions of these plains, covering them with great spreading tufts. Close to the hills, and at an altitude of 3000 feet, *Amygdalus eburnea* occurs as a low shrub. Where there was the least shelter, as in dry water-courses and irregular depressions of the ground, there was a low scrub of *Tamarix gallica*, *Lactuca orientalis*, *Pteropyrum Aucheri*, *Calligonum*, *Atraphaxis*, *Ruta*, *Stellaria*, *Convolvulus erinaceus*, *C. fruticosus*, and *Nitraria*, with various species of *Cousinia*, *Centaurea*, and *Ephedra*. Where there was any indication of moisture, as in the vicinity of cultivation, there was abundance of *Ammothamnus Lehmanni*, *Sophora pachycarpa*, with *Zygophyllum Fabago* and *Cleome coluteoides*, having curiously inflated purplish-coloured fruit; and in certain localities where the clay soil was largely charged with saline matter and cut up into low irregular mounds (one could scarcely call them hills), a curious plant, *Miltianthus portulacoides*, was found, with, for its size, enormous, spongy, much-decayed root-stocks, and a profusion of copper-coloured flowers. This was the only herb that grew on this peculiar formation. In proceeding north from Khusan, at Toman-agha and still further north, a very marked species of Rhubarb, *Rheum tataricum*, occurred in the plains. The showy part of this plant was usually three enormous root-leaves, each measuring when full-grown about four feet across, and spread out flat on the ground. The flowering stem averages from two to three feet in height, and terminates in a loose panicle of flowers, which in due season develops large ruby-coloured, or sometimes yellow, winged fruit. From the novel and striking appearance presented by the leaves and fruit of this Rhubarb, it might prove a valuable acquisition to the stores of the landscape-gardener. I am glad therefore that I was able to obtain a large quantity of the seed, part of which has already germinated successfully at Kew.

On the left bank of the Hari-rud, near Ghorian, a large expanse of saline country exists, where flourished almost every species of Chenopodiaceæ which I had collected elsewhere. Here were *Atriplex*, *Eurotia*, *Halostachys*, *Suæda*, *Haloxylon*, *Salsola fœtida*, *S. arbuscula*, *S. auricula*, *S. Kali*, *Anabasis*, &c., together with *Statice perfoliata*, which grows very much in the way of a *Rubus*, having large trailing branches, *Statice suffruticosa* in tufts covered with saline matter, and *Frankenia* in great abundance.

At Zindijan, one of the few Afghan villages which I visited, there was a considerable amount of cultivation, which, however, was much hindered by a continuous deposit of sand blown across the river from the low hills on its right bank. To such an extent does the sand accumulate that portions of the village are almost buried, and great drifts have formed on the weather-side of all the walls. Where there was much sand spread over the level ground, the turf consisted solely of *Plantago maritima*. In August, when I last visited Zindijan, the field crops had been harvested, and all irrigation had ceased, so that water was only to be obtained from the river some distance off, or from reservoirs enclosed and roofed over. Throughout the whole of my wanderings I neither saw nor heard of a single well lined with masonry, such as one meets with in India. The roofed reservoirs keep the water cool in summer, and prevent its freezing in winter; but, although the water deposits all the soil and foreign matter usually held in suspension by river-water, it subsequently becomes highly charged with various organic impurities, rendering it for drinking-purposes extremely injurious to the general health of the community.

THE BADGHIS DISTRICT.

Badghis is the term applied to that part of the country to the north and east of the Paropamisus range of mountains. The members of the Mission traversed this district, entering it by the Chashma-sabz Pass (5000 ft.) on the south-west, and skirting the northern slopes of hills in an easterly direction, by way of Karo-bagh, Kushk, Kalla-nao, Ab-i-kamara, and Tor-shakh to Bala-morghab, where they wintered, returning in the early spring to Gulran through Mara-chak, Kalla-i-maur, Chaman-i-bed, and Islim. Along this route I do not think we ever ascended above an altitude of 4000 feet, and the entire country to the north of the line we took, between Karo-bagh and Kalla-nao, does not average above 3000 feet in altitude. This country is drained by the Kushk and Morghab rivers, and constitutes a continuous succession of ranges of low hills, like sand dunes, the soil of which is composed chiefly of a rich mould in addition to sand, and where occasionally there is sandstone rock *in situ*. The climate of this region is very different from that of the portion of the Hari-rud valley already described. It is much more humid, due to the drainage which passes through it from the melting snow of the surrounding high ranges of hills, as well as to that moisture, derived more indirectly from the Caspian, which in the shape of clouds rolls eastwards along the ridges of the hills lying between the Caspian and the Hari-rud. It is therefore characterized not only by a greater verdure and a more luxuriant vegetation, but these conditions are of a more permanent nature than in the valley of the Hari-rud. The temperature in winter falls several degrees below zero, and in summer, I believe, the heat never reaches anything approaching that experienced in the adjoining plains. Generally throughout the year there is also much less wind, although sudden storms of wind, accompanied by rain and hail, do occur in summer, and prove very destructive to all forms of vegetation.

The only places where I saw cultivation in the Badghis were on the banks of the Morghab river and near Kalla-nao, chiefly by the aid of irrigation; for although crops of wheat and barley were raised without it, they were inferior in quality. The natives greatly enrich the soil by dressing it with manure, which they obtain from their immensely numerous flocks of sheep and goats. As it was the depth of winter when we were at Bala-morghab my information was mostly obtained from native reports, from which I could not discover that there was any exceptional cultivation, but maize and rice were said to be grown largely at Panjdeh. The fuel brought into camp consisted of the wood of juniper, pistacio, and *Celtis*. In the immediate vicinity and for some few miles out of camp I did not see a single tree of any sort; and to show how they are prized when they do occur, a solitary pistacio tree which we saw on our march to Mara-chak, perched on a distant hill, gave to the shrine near which it grew the name of the "one-tree shrine;" but I was told that forests of various trees existed in the Tir-band range. In the neighbourhood of Bala-morghab I noticed numerous deep holes, which on inquiry I found had been made by the natives digging out the turnip-like roots of *Crambe cordifolia*, upon which they feed their camels during winter, and which are frequently stored for this purpose. The only plants I collected here which I was able to identify are:—*Eranthis cilicica*, *Crocus Korolkovii* (the most eastern species of the genus), *Taraxacum officinale*, *Merendera persica*, and *M. sobolifera*, the last a very pretty creeping herb, growing in damp soil on the margin of water, or where the ground was flooded. During February, on the sun coming out brightly, these flowers open up like so many stars amongst the short grass. In the fields *Prosopis Stephaniana*, *Alhagi Camelorum*, *Peganum Harmala*, and a *Glycyrrhiza* were common. On our march to Gulran, with snow occasionally lying on the ground, *Merendera persica* grew in great luxuriance in clumps consisting of numerous flowers from each corm, and owing, I suppose, to its arid and colourless surroundings appeared very showy and brilliant. In the bed of the Morghab, a tamarisk, some tall grasses, species of *Arundo* and *Phragmites* formed a dense thicket, which gave excellent cover for pigs and numerous pheasants. On the march to Kalla-maur I saw for the first time plants of the singular Umbellifer, *Ferula oopoda*, bearing enormous cup- or bowl-like stipules; and though completely dried up, it still showed signs of having been a very handsome plant. It was said to be common round Bala-morghab and to enter northwards into the salt desert, but, like all the vegetation of these parts during winter, had utterly disappeared. Subsequently I found it in all its spring beauty at Gulran, and again in the Hari-rud valley and Khorasan.

The vegetation of the Badghis divides itself naturally into that found upon the dunes, which reach an altitude of from 1500 to 3000 feet, with a soil varying from pure sand to a rich alluvial mould; that met with at a similar altitude but upon gravel or rock formation; and lastly that which occurs on the Paropamisus range from an altitude of 3000 feet to a little above 5000, this being about the highest point at which I collected. The loose soil of these dunes was covered with a close turf of *Carex physodes* and *C. stenophylla*, the former of which is remarkable for its largely inflated chocolate-coloured utricles. For a short period the hillocks are tinted an exquisite blue by the flowers of *Gentiana Olivieri*, which is, as Boissier noted, the hot-country gentian. This is followed by *Delphinium Zalil*, a perennial which throws up a spike of bright yellow flowers two feet in height. Its showy blossoms suddenly cover the downs, which they illuminate with their brilliant colouring, affording a sight never to be forgotten. In some localities, as at Gulran, *Ferula galbaniflua* was found in great luxuriance, its early spring stems and leaves being greedily devoured by our camels; and *Fritillaria Karelina* covered the meadows in all directions with its graceful and lovely spikes of flowers. *Leontice* and *Bongardia* (genera previously unknown to me), with numerous *Eremuri*, *Gagea*, a fine *Tulipa*, several *Onobrychides*, some of them new, with *Biebersteinia*, and the small dwarf yellow single-leaved *Rosa berberifolia*, were in profusion everywhere. Mixed with them, but occasionally in meadows apart from them, were several grasses, the most characteristic of which were *Poa bulbosa* and, later in the season, *Agropyrum Aucheri*. *Tanacetum umbelliferum* with large yellow flower-heads, displayed occasional fine patches of colour, and *Camelina sativa* and *Gypsophila paniculata* were abundant everywhere, the latter especially so, over ground which had been years ago under cultivation.

It may be noted here that throughout the whole Badghis the remains of a system of irrigation-works were constantly coming under our notice—indications of a bygone period when the country was inhabited by a vast and energetic population. Near water several tamarisks were common, and associated with them *Apocynum venetum* was abundant. This plant I first saw in winter, when it was leafless, showing a thicket of the annual shoots of several years' growth; but what attracted my particular attention to it were the heaps of naturally removed fibre lying at their roots. They still bore fruit, some of which, with cuttings from the last year's stems and a large bundle of fibre, I despatched to Kew; and living roots I sent to Seharanpore. From the fine quality of the fibre, and hearing that the natives employed it in the manufacture of cloth, I thought it worthy of special attention.

In the valleys of the dunes, where there is some local non-saline moisture, there were immense beds of underscrub, formed by a robust, tall, perennial, *Codonocephalum Peacockianum*, a new species of a previously monotypic genus, which grew to a height of about five feet; and a similar underscrub consisting solely of *Gundelia Tournefortii*, remarkable for the large spinous involucre surrounding the flower-heads. These plants extended for miles, looking at a distance like cultivated fields, but on a closer inspection proving to be dense thickets almost impassable by man on foot, and providing admirable cover for pigs, tiger, and other game. Strange to say, this luxuriant growth had totally disappeared by the beginning of winter, the decay of which no doubt accounts for the large amount of rich mould in various parts of the Badghis.

On the gravelly soil and rock formation *Amygdalus eburnea* was very luxuriant, forming a shrub from two to six feet in height, and presenting a beautiful sight when in full blossom. There were also many *Astragali*, several of which are regarded as new; *Onobrychis*, the superb *Lathyrus subvillosus* in dense clumps and well worthy of the horticulturist's attention; *Mathiola albicaulis*, having a very handsome flowering stem two to three feet in height, usually with rather dull-coloured purplish flowers, but sometimes pure white or greenish; several *Statice* with showy flowers; *Crambe cordifolia* very plentiful, with ample foliage and inflorescence, with sweetly scented flowers; *Thalictrum*, *Conringia*, *Galium*, *Arum*, diffuse at the roots of tamarisk and berberry bushes; *Eremostachys diversifolia* with splendid flowers and curiously knotted roots; numerous species of *Allium*, the variety *Charlesii* of *Geranium tuberosum*, having spheroidal superposed tubers; *Anemone biflora*, *Thalictrum isopyroides*, several splendid *Eremuri*, and the new *Iris Fosteriana*. Up to the altitude of 3000 feet there are few shrubs and no trees, unless the formation consists of sandstone rock, where there are forests of *Pistacia vera*, which were first encountered on our march between Karez-darra and Padda, subsequently near Gulran and again at Karez-Ilias, where a portion of the country, owing to the prevalence of this tree, goes by the name of *Pistalik*. The tree has little or no main trunk, and branches freely from the base. During winter, when leafless and seen along the edge of the cliffs against the sky, the peculiar grey colouring of its bark gives one the impression of smoke. We saw occasional clumps of it all along our route through the Badghis. The pistacio nut is an article of considerable commercial importance, being largely exported to India from these very forests; and the wood is the most valuable for fuel of any found in the country. At the foot of the same rocks, growing in the sand accumulated from their disintegration, was the very luxuriant *Corydalis Sewerzovii*, having large bright yellow flowers. In certain localities and exposures in the Paropamisus range, at an altitude of 3000 feet and upwards, trees begin to appear, the most prominent being *Juniperus excelsa*, chiefly valued for its wood for construction and fuel; *Cratægus Oxyacantha*, *Elæagnus hortensis*, *Lonicera nummularifolia*, the last usually as a large shrub, but occasionally forming scattered forests of short trees with great boles; several species of *Prunus* and *Cotoneaster Nummularia*, well known to the natives as yielding *Shir-khist*, a kind of manna largely exported as well as consumed by the inhabitants. The last is local, owing to the nature of the soil. In some of the deep valleys between Kushk and Palounda I saw *Zizyphus vulgaris*, with a species of *Pyrus*, and an *Acer*, all apparently indigenous. I did not meet with any oaks or pine, but heard of *Pinus halepensis* occurring in the Paropamisus range, at a shrine around which it has extended its area. Other characteristic types of a high altitude were *Rheum Ribes* in immense beds, *Rosa*, *Solenanthus circinnatus*, *Smyrnium cordifolium*, *Prangos pabularia*, and *Alyssum persicum*.

At its north-west limit the Paropamisus range breaks up before it reaches the Hari-rud and spreads out into a fan-shaped expanse of low hills, ordinarily not over a few hundred feet above the level of the river (which is here about 2000 feet above the sea), with the exception of a few solitary peaks such as those of the Sim-koh, which in all probability are not over 3500 feet in altitude. On the 14th May I started on a tour from Kumani-besht through this expansion of the range, across the Nihal-sheni pass to Chil-gaz, Karez-Ilias, and Sim-koh, to the east of the Kambao pass. The soil of this district being saline, pure sweet water is only to be obtained in a few localities; hence there is no cultivation. Indeed the country is practically a desert, and only occasionally used for pasturage, the distance between the watering-stations rendering it almost valueless for grazing purposes. Between Toman-agha and Kumani-besht, close to the river, rises a range of high clay cliffs, a counterpart of those called Takht-i-Rustam on the Hamun. On ascending these cliffs they were found to be the edge of a continuous plateau, extending to the Paropamisus on the east and north, and consisting of vast alluvial deposits. The general aspect of the vegetation here strongly resembled that around Tirphul, but contained a good many new and interesting types. The first remarkable plant observed was *Statice spicata*, growing chiefly in the washings of sand at the base of the cliffs, and which although only a few inches in height was very attractive from the bright pink colour of its spikes of flowers. Along with it, conspicuous by its dark foliage rather than for anything else, was *Statice leptostachya* frequently covering the plateaus in the low hills. Where water accumulates, owing to clay deposit, on these plains, a matted turf-like sward composed solely of creeping *Lepidium Aucheri* is specially noticeable; and in the gravelly soil several species of *Tragopogon*, *Scorzonera*, and *Lactuca* occur in abundance. The chief grasses were *Poa bulbosa*, *Bromus Danthoniæ*, and in many places *Hordeum ithaburense* was in such profusion and so much resembled cultivated fields, that my followers called it wild barley, an opinion shared by most of us; further, *Triticum squarrosum*, *Hordeum Caput-medusæ*, and *Melica ciliata* were prominent elements of the pasturage. Various species of *Allium* were equally abundant, giving their own peculiar colouring to immense tracts of country. In the water-courses *Tamarix gallica*, *T. tetandra*, and *Dorema glabrum* were found; the last throwing up flowering stems fully twelve feet in height, clothed with a blaze of mimosa-like flowers, and forming a thicket in the shade of which a large *Atriplex* was very luxuriant, and was greedily eaten by our cattle and camels. At Sim-koh we encamped at the base of the hill of that name, at an altitude of about 3000 feet, the hill itself being about 500 feet higher, and in the vicinity of a fine perpetual spring of water. Here in the deep gorge of the stream *Morus alba*, a large indigenous tree, was common, associated with *Celtis caucasica* and a large shrubby *Ficus*, which is without doubt the wild condition of the cultivated fig. The *Celtis* I had not seen before, although much of the fuel we used during the previous winter at Bala-morghab was the wood of this tree. At Tirphul I had seen stunted plants of the *Ficus*; but here it was a fine large shrub laden with the yet unripe fruit, covering the whole southern exposure of the Sim-koh hill. *Salix acmophylla* grew plentifully in some of the water-courses, especially between Sim-koh and Karez-Ilias. In the alluvial soil at the source of the stream *Glycyrrhiza glandulifera* grew in great luxuriance, reaching a height of fully nine feet, with *Althæa officinalis*, not met with elsewhere. *Rosa anserinæfolia* was common on the rocks; and at a waterfall I collected my only Afghan fern, *Adiantum Capillus-veneris*. Here, as well as near Karez-Ilias, on the gravel slopes of the water-courses the indigenous form (*S. tetranda*, Stev.) of *Spinacia oleracea* was common, and recognized by the Afghans as *Spinaj* or *Spinahk*. In addition to the plants already named various species of *Acantholimon*, *Eremostachys*, *Cousinia*, and *Artemisia* were plentiful, with several species of *Orobanche* parasitic on the last two genera.

MOUNT DO-SHAKH.

From Zindijan I visited the Do-shakh range, which forms the watershed between the Hari-rud and Harut rivers. These hills are of limestone formation, with an extremely jagged outline, and have two principal peaks, from which the range takes its name, and which are probably not above 4,500 feet in altitude. On the journey I found *Cousinia Deserti* and *Cousinia heterophylla* both very common on the gravel plateaus, with *Cnicus arvensis*, *Lactuca orientalis*, *Eryngium carlinioides*, and *Ephedra*, covering vast tracts of country; and here and there a few patches of *Andropogon laniger*. In some of the dry water-courses *Glycyrrhiza triphylla* was very prevalent, growing in luxuriant beds, bearing numerous spikes of lovely white flowers, succeeded by curious brown bristly pods. *Astragulus anisacanthus* and *Convolvulus fruticosus* were likewise common; the latter an extremely stiff, woody, thorny species, most unlike any of our British *Convolvuli*. *Chenopodium Botrys* occurred in large tufts, and was collected and used as a pot-herb by my guides. On reaching Kishimaru, an encamping ground, I found a stream of water which issued from the northern base of the Do-shakh hills, close to one of the main peaks. I followed this watercourse up to its source and found *Cercis Siliquastrum* as a large bush up to twelve feet in height, forming a thicket on both sides of the stream. I did not meet with this elsewhere in

Afghanistan; and I was told here that the shrub was of no use, not even for fodder; but near Meshed I found that the people used its annual shoots for basket-work. Except near water the northern declivity of these hills is entirely devoid of vegetation; but on these southern exposures I found several good examples of *Pistacia Terebinthus*, var. *mutica*; *Salix babylonica*, a large tree in the vicinity of water; and in the clefts of the rocks, the same *Ficus* as that collected at Sim-koh was occasional, and in the stream-beds numerous groves of tamarisk. It should be mentioned that several small streams which originate in this range, after running for some distance, gradually sink into the soil, and disappear.

KHORASAN.

I made two journeys into Khorasan as far as Meshed, on the first occasion travelling by Turbat-i-Shaikh-Jami, and on the second by Rui-khauf and Turbat-i-Haidri. The most interesting portion of these journeys, botanically speaking, was that experienced in the hills south of Turbat-i-Shaikh-Jami, near Bezd, which reach an altitude of perhaps 7000 feet. The village of Bezd lay hidden at the base of the hills, and was well watered by a stream. Here I first saw some fine orchards of splendid walnut trees, besides all the fruit trees previously mentioned, with the almond and peach in great luxuriance; and in addition to the common trailing vine, there was a standard variety bearing a rather sweet green grape said to be seedless. *Rhus coriaria* was cultivated for its leaves for dyeing and tanning processes, and the pistacio was cultivated, which last I was told was not the case in Afghanistan. In the village there were some fine trees of *Platanus orientalis*, and in the orchards the mulberry trees were remarkable for their immense size. I was informed that for some time back sericulture had ceased, owing to disease amongst the silk-worms, but that the village had been celebrated for the yield of its silk some fifty years previously. The inhabitants have now in its place taken to the cultivation of the poppy for the production of opium, which was proving the ruin of the inhabitants, as every one, even children, either smoked or ate the drug.

I made an excursion into the hills by following up the stream-bed, and at about 5000 feet I found myself in a deep gorge between cliffs of limestone and conglomerate rocks. On these *Dionysia tapetodes* occurred in moss-like clusters with *Campanula incanescens*, *Parietaria officinalis*, and *Cheilanthes Szovitsii*, the last being the second fern that I had seen or collected in my wanderings, besides a species of *Euphorbia*, remarkable in habit of growth, in the clefts of the rock. Before I had it in my hand I thought it was another fern, owing to its resemblance to an *Asplenium*. In the water-courses, along with shrubs of *Berberis*, *Cotoneaster*, *Elæagnus*, *Lonicera*, *Prunus*, *Salix*, and *Rosa*, was a tall diœcious species of *Lychnis*, with *Orchis laxiflora* and *O. latifolia*, *Scrophularia alata*, and *Iris Gueldenstaedtii*. Between the stream-bed and the rocks the gnarled, woody, dwarf, scrubby *Rhamnus persica* was common, with several grasses, including *Oryzopsis cærulescens* in great beds; *Arrhenatherum Kotschyi*, an oat-like grass with curious bulbous roots, and *Agropyrum repens*. The showy *Hemenocraster elegans* was in great luxuriance, its large rose-coloured calyces rendering it very conspicuous; *Eremurus aurantiacus*, brilliant against the dull colouring of the rocks; finally *Codonocephalum Peacockianum* and a *Hyoscyamus*, perhaps a variety of *H. Senecionis*, the last creeping amongst the boulders.

At 6000 feet the hill became very barren, and such plants as flourished were grazed to a sward by the sheep. Much of this herbage consisted of a *Pedicularis*, of which I could not obtain a single good flowering or fruiting specimen, together with *Alyssum persicum*, *Hypericum scabrum*, several species of *Echinospermum*, and *Jurineæ*, *Geranium collinum*, *Onobrychis* in immense broad hummocks, *Erysimum persipolitanum* and a new one-flowered *Astragalus* (*A. Durandianus*), *Gaillonia*, *Paracaryum*, and *Pteropyrum*.

In traversing the northern slopes of these hills, at an elevation of 5000 feet, I saw plateaus covered with *Eremuri*, chiefly *E. algæ* and *E. aurantiacus*; but my principal object was to visit the locality where the bulk of the gum called *Katira* was collected for exportation. I found it was the product of *Astragalus heratensis* and another species, near *A. strobilifera*, Royle, growing like miniature oaks. The gum tragacanth or *Katira* was collected from natural exudations from cracks in the bark of the lower branches and near the root. I also went to see a forest of trees called here *Kinjak*, the leaves of which are employed in dyeing. From the description of it given me, I thought it might prove something new; however, it turned out to be *Pistacia vera* in a wild condition, and bearing barren fruit. I was glad to be able to visit and see these trees for myself; otherwise I should have always fancied that in this part of Persia another tree existed of which I had collected no specimens. It is curious to note that the Persians will not admit that *Pistacia vera* exists as a wild tree in this neighbourhood. Here also I saw thin forests of *Lonicera nummularifolia* yielding fair timber. At about the same altitude, *Juniperus excelsa* was a good-sized tree and common. Hummocks of *Astragalus angustifolius*, and with it *Acanthophyllum macrodon*, having a similar habit. The roots of the latter are largely collected and employed as a substitute for soap. In some places barley and wheat were growing without irrigation; and in these fields *Gladiolus Kotschyanus* was prevalent. In many of the villages in Khorasan, but more particularly at Rui-khauf, I found *Pinus halepensis*, cultivated in long rows on the windward sides of orchards for protection. Of these there were some very fine trees fully 100 feet high and nine feet in circumference.

GENERALIZATIONS ON THE FLORA OF NORTH-WEST AFGHANISTAN.

The flora of North-western Afghanistan differs much from the typical flora of Eastern Afghanistan, so graphically described by Hooker and Thomson in their introductory essay to the 'Flora Indica.' On comparison of data, I have been led to the conclusion that this difference is due to climatic conditions. The winter is much more severe and of longer duration at similar altitudes than that experienced in Eastern Afghanistan, the temperature falling several degrees below zero (Fahrenheit), and snow lying for some days at an altitude of 2000 feet. In spring the persistence of damp and cold is also more prolonged—rain, which at any moment might be converted into sleet and snow, occurring occasionally as late in the season as the end of May. The highest temperature is in July and August, reaching 105° in the shade; and although the summer is very much shorter than that in the tropical zone, the weather is intensely hot while it lasts, no dew falling under an altitude of 3500 feet. These extremes of temperature between summer and winter and night and day are much intensified by the absence to the north of any mountain-range affording adequate shelter from the continuous blasts of bitterly cold wind in winter and of hot dry air in summer, coming from the north-east and north-west respectively. The mountains in the vicinity not being sufficiently high to retain perpetual snow, the water-supply is limited to the rivers Hari-rud and Morghab and to a very few perennial springs.

With such climatic conditions cultivation, below an altitude of 3500 feet, is impossible without the aid of irrigation, except under the ameliorating influences of a river; and until the dew-line is gained it is a land totally devoid of trees or even shrubs. But as soon as this point is reached *Pistacia vera*, *Juniperus excelsa*, and *Lonicera nummularifolia* appear as forest-trees, and wheat and barley no longer need irrigation.

I may mention here that my collections do not wholly consist of what is usually regarded as the oriental flora, for they contain a considerable admixture of Siberian and Central Asiatic types; and doubtless the proportion of the latter would have been larger had I been able to collect at greater altitudes, as it is there where the greatest overlapping of the two elements occurs. There are also a few Western Himalayan or Tibetan plants, and a very limited number common to the Punjab and Scind regions. The local species comprise, in all probability, one sixth of the whole collection.

I met with no indigenous Coniferæ except *Juniperus excelsa*, but *Pinus halepensis* is cultivated. There were no oaks, nor any species of the genera *Æsculus*, *Olea*, or *Myrtus*.

The tropical zone, spoken of by Hooker and Thomson as skirting the Afghan region, does not extend to the north-west, owing to the excessive fall in the winter temperature and the shortened summer; a conclusive proof of this is the absence of the date-palm. The area of *Pistacia Terebinthus*, var. *mutica* (*Kinjak*), is limited to the southern aspect of the Do-shakh range. A few subtropical shrubs from Scind and the Punjab do just exist through the low winter temperature, namely, *Peganum Harmala*, *Prosopis Stephaniana*, *Alhagi Camelorum*, and *Capparis spinosa*, with the grasses *Erianthus Ravennæ* and *Andropogon laniger*. *Populus euphratica* forms forests in the river-beds; but as long as this tree is situated near water, it is indifferent to altitude, being known to extend from Scind and the Punjab to Western Tibet, up to a height of 12,000 feet. A more curious extension is *Haloxylon Ammodendron* from the apparently dry shifting desert sands of Baluchistan to the river-beds of this area. *Pulicaria foliosa* is the only plant collected whose area extends from India proper (Banda, in Bandelkhand, on the Jumna river) to this region.

Among the Himalayan types met with were *Sisymbrium himalaicum*, *Sophora mollis*, *Rosa moschata* (cult.), *Prangos pabularia*, *Pterotheca Falconeri*, and *Epilasia ammophila*, with several of the Chenopodiaceous shrubs found in the arid Tibetan region. Of species common to Central Asia I may name *Nigella integrifolia*, *Corydalis Sewerzovii*, *Isatis Boissieriana*, *Crucianella filifolia*, *Kuschakewiczia turkestanica*, *Convolvulus subhirsutus*, *Astragalus buchtormensis*, and *Orobus subvillosus*.

As already mentioned, I had little opportunity afforded me for investigating the Alpine flora of this country, seldom having been able to collect in localities above 5000 feet in altitude, though above this height, in exposed positions, I found that there were neither trees nor shrubs. The change in the vegetation was represented by certain types of plants, as *Acanthophyllum*, *Astragalus*, *Onobrychis*, &c., assuming a peculiar habit, forming dense solid bushes, which look like small knolls or hummocks. Above this level occurred a belt of *Euphorbia*, exactly as seen in Kashmir and Kuram; and still higher the soil was covered with a close pasturage of *Pedicularis*, *Alyssum persicum*, *Erysimum persepolitanum*, and various *Astragali*. At 7000 feet the soil was absolutely sterile. What are generally understood as subalpine forms, such as *Rheum Ribes*, a *Primula*, and a Gentian (the only one I met with), extended down as low as 2000 feet in some places.

ITINERARY.

Alt. in feet.		1884.	
5,604.	Quetta	Sept.	
	Spangaoli	„	22
	Gobrak	„	23
	Khanak	„	24
	Panj-pai	„	25
	Chaman	„	26
	Kaisar	„	27
	Nushki	„	28, 29
	Sanduri	„	30
2,960.	Band	Oct.	1, 2
2,840.	Omar-sha	„	3, 4
2,780.	Zaru	„	5
2,700.	Kani	„	6
2,680.	Gaz-i-cha	„	7
3,370.	Safia	„	8
3,860.	Sha-ismail	„	9
3,890.	Salian	„	10
4,010.	Boz-dan (Muzh-dan)	„	11
4,110.	Mannu (Mamu)	„	12
3,110.	Gal-i-cha	„	13, 14
	Gar-nushki	„	15
1,550.	Hadj-ali (Khwaja-ali)	„	16–19
	Lundi	„	20
1,510.	Rudbar	„	21
1,500.	Koh-haja (Khaja)	„	22
1,490.	Chakr-burja	„	23
	Kalifat	„	24, 25
1,440.	Padda-sultan	„	26
1,400.	De-kamran	„	27
1,300.	De-doda (Deh-dadeh)	„	28
1,300.	Ibrahim-abad	„	29, 30
1,290.	Mak-barra-habil	„	31
1,280.	Takht-i-Rustam	Nov.	1
1,420.	Jowain (Lash-Jowain)	„	2
1,480.	Kushk-rud	„	3
1,520.	Kin	„	4
	King	„	5
1,920.	Zagin	„	6, 7
2,300.	Sang-bar	„	8

Alt. in feet.		1884.	
3,420.	Karez-dasht	Nov.	9
3,210.	Ser-mandel	„	10
3,620.	Sher-baksh	„	11
3,500.	Gaz-i-cha (Gaz-ak-cha)	„	12, 13
3,450.	Pahir (Parah)	„	14
2,270.	Zindijan	„	15, 16
	Roznak	„	17
1,950.	Khusan	„	18–25
	Halfway to Chashma-sabz	„	26
	Chashma-sabz	„	27
	Asia-deh (Asir-deh)	„	28
	Kar-o-bagh	„	29
2,850.	Tut-i-chi	„	30
	Aftao (Haftu)	Dec.	1
4,300.	Kara-kainta (Kara-ghaitu)	„	2
	Kushk	„	3–5
	Palounda	„	6
	Karez-darra	„	7
	Padda (Paddai-paj)	„	8
	Ab-i-kamarra	„	9
	Ab-i-shora	„	10
	Tor-shakh	„	11
	Marjan	„	12
	Bala-morghab	„	13
1,330.	Bala-morghab (Fort)	„	14
	Halted here until the 15th Feb., 1885.		
		1885.	
	Karaol-khana	Feb.	16
	Mara-chak	„	17
	Ab-i-goshan	„	18
	Kalla-i-maur	„	19, 20
	Chaman-i-bed	„	21
	Islim	„	22
	Locality without name	„	23
2,240.	Gulran (New Fort)	„	24
	Halted here until the 14th March.		
	Gulran (Old Fort)	Mar.	15
	Halted here until the 1st April.		

Alt. in feet.		1885.	
	Ao-safed (Pass)	April	2
	Chasma-sabz (Spring)	„	3
	Tirphul	„	4
	Halted here until 25 April.		
1,950.	Khusan	„	26
2,180.	Toman-agha	„	27, 28
	Gal-i-cha	„	29
	West of Kambao Pass	„	30
	East of Kambao Pass at Burj	May	1–3
	Shore-kaltegai	„	4
2,240.	Gulran (New Fort)	„	5
	Gulran (Old Fort)—Chasma-sabz Pass to Tirphul	„	6, 7
2,100.	Tirphul (Halt)	„	8
	Tirphul moved to encampment opposite to Khusan	„	9–11
1,950.	Khusan (Village)	„	12
	Buniad-khan	„	13
2,070.	Kumani-besht	„	14
	Chil-gaz	„	15
	Karez-ilias	„	16
	Chil-gaz	„	17
	Sim-koh	„	18, 19
	Kambao burj	„	20
	Sang-haji	„	21
	Ao-Safed (East Base)	„	22
	Baba-furk	„	23
	Kohtal-sangi (Pass) (North side)	„	24
	Kohtal-sangi (Pass) (South side)	„	25, 26
	Dana-sanjiti	„	27
	Chinkilok	„	28
	Halted here until June 3rd.		
	Shekewan	June	4
	Roznak	„	5
	Shabad	„	6
	Tirphul (Second encampment opposite Khusan)	„	7
	Kalla-i-dast Dargarri	„	8
	Karez	„	9
	Hauz-i-safed	„	10
	Turbat-i-shaikh-jami	„	11
	Halted here until June 15th.		
	Bezd	„	16
	Halted here until June 19th.		
	Turbat-i-shaikh-jami	„	20
	Halted here until June 29th.		
	Langar	„	30
	Khairabad	July	1
	Kalanderabad	„	2
	Farrah-gird	„	3
	Sang-bast	July	4
	Turukh	„	5
3,100.	Meshed	„	6
	Halted here until July 15th.		
	Turukh	„	16
	Sang-bast	„	17
	Fareh-man	„	18
	Karez-badak	„	19
	Abdullabad	„	20
	Turbat-i-shaikh-jami	„	21–23
	Rud-i-rabask	„	24
	Karez	„	25
	Kafir-kalla	„	26
	Khusan (Left Bank)	„	27, 28
	Robat-i-kalcha	„	29
	Ghorian	„	30
	Zindijan (Village)	„	31
	Zindijan (Encampment)	Aug.	1–3
	Cha-dlermu	„	4
	Kishmaru	„	5
	Do-shakh (Mt.)	„	6
	Puza-gish	„	7
	Kilki	„	8
	Halted here until Aug. 16th.		
	Puza-gish	„	17
	Do-cha-i-ibrahim-khan	„	18
	Robat-i-turk	„	19
	Musabad	„	20
	Burj-i-ayubi	„	21
	Khal-i-khurdian	„	22
	Sangun	„	23
	Madrassa	„	24
	Rui-Khauf	„	25
	Halted here until Aug. 31st.		
	Salami	Sept.	1
	Malkat	„	2
	Sangan	„	3
	Nasarabad	„	4
	Turbat-i-haidri	„	5
	Halted here until Sept. 9th.		
	Maimadabad	„	10
	Kishmatabad	„	11
	Robat-i-safed	„	12
	Sharifabad	„	13
	Robat-turukh	„	14
3,100.	Meshed	„	15
	Halted here until the 1st October, when I left for England, marching through Persia, *viâ* Sabsawar and Sharud to Astrabad, thence *viâ* the Caspian to Baku, by rail to Batoum. My collections were conveyed by sea from Batoum direct to England.		

In conclusion, I have to thank Sir Joseph Dalton Hooker, K.C.S.I., C.B., the late Director, and Mr. Thiselton Dyer, C.M.G., the present Director of the Royal Gardens at Kew, for having afforded me every facility at the Royal Herbarium; to Professor Oliver for his assistance in the determination of many species, and the liberality with which he permitted me to consult him. To Mr. Baker I am again indebted for identifying the Leguminosæ and Monocotyledones Petaloideæ; to Dr. M. C. Cooke for his determinations and descriptions of the Fungi, and to Mr. N. E. Brown for the identification of the Aroids and other assistance.

I feel that I cannot sufficiently thank my friend Mr. W. B. Hemsley, who has again come to my assistance as my coadjutor in working out this my third collection of Afghan plants. I need not say that without his valuable aid this paper could not possibly have been completed within the period prescribed by the Government of India.

I have to thank Miss Smith for her excellent drawings and dissections under Mr. Hemsley's supervision.

ENUMERATION OF THE PLANTS.

RANUNCULACEÆ.

Clematis orientalis, Linn.; Boiss. Fl. Or. i. p. 3; var. foliorum segmentis angustis.

Northern Baluchistan: 6, Sept. 27, 1884; Hari-rud valley: 772, August 5, 1885.

Common in the beds of streams amongst Tamarisk.

Thalictrum isopyroides, C. A. Mey.; Boiss. Fl. Or. i. p. 6.

Hari-rud valley: 427, May 10, 1885; Badghis: 345, April 29, 1885.

Profuse in clay soil amongst stones and rocks in the low hills.

Anemone biflora, DC.; Boiss. Fl. Or. i. p. 12.

Badghis: 378, May 2, 1885; May 1, 1885.

Not uncommon in the clefts of sandstone rocks. The persistent sepals increase largely in size until the fruit ripens.

Adonis æstivalis, Linn.; Boiss. Fl. Or. i. p. 17, et var. floribus majoribus.

Hari-rud valley: 235, April 13, 1885.

Occurs in two forms, one with small flowers, generally spread over the whole country; the second with large flowers, usually in corn-fields and on cultivated land.

Ranunculus aquatilis, Linn.; Boiss. Fl. Or. i. p. 23, var. foliis omnibus dissectis, segmentis filiformibus.

Khorasan: 815, August 29, 1885.

Was seen also in the basin of the Harut river; and in the Badghis, in the Kushk stream.

Ranunculus (§ Euranunculus) leptorrhynchus, Aitch. et Hemsl., n. sp. (Plate I.)

Herba perennis, erecta, 4–12 poll. alta, parce adpresse hirsuta, radicis fibris fasciculatis elongatis subcarnosis, caule sæpius triflori. *Folia* radicalia usque ad 3½ poll. longa, petiolata, nunc tripartita nunc pinnatipartita, segmentis angustis acutis trilobatis vel lateralibus interdum aut bilobatis aut integris; caulina superiora subsessilia, tripartita, segmentis fere linearibus. *Flores* aurei, 1–1¼ poll. diametro, longe pedunculati, pedunculis teretibus; sepala patentia, late ovata, obtusissima, extus hirsuta, margine membranacea, colorata; petala obovata, venosa, subunguiculata, basi squama lata truncata vel leviter rotundata instructa. *Carpella* numerosissima, longe spicata (matura non visa), glabra, lævia, valde compressa, oblique rotundata, infra insertionem magis producta, longe arcuatim uncinato-rostrata, rostro tenui.

Hari-rud valley: 210, April 12, 13, 21, 22, 1885.

Very abundant in the shingle plains of the Hari-rud valley as well as in the Badghis.

The plant varies from one foot to two feet in height, and the flowers increase in size as the fruit forms; it sends out stolons which bear young plants.

RANUNCULUS ARVENSIS, Linn.; Boiss. Fl. Or. i. p. 57.

Paropamisus range: 556, May 24 and 25, 1885.

Not common, in moist meadow soil, at an altitude of 3500 feet and upwards.

RANUNCULUS FALCATUS, Linn.—*Ceratocephalus falcatus*, Pers.; Boiss. Fl. Or. i. p. 58.

Hari-rud valley: 149, April 2, 1885.

Spread over the whole country, and flowering in early spring, under the shade of shrubs.

ERANTHIS CILICICA, Schott et Kotschy; Boiss. Fl. Or. i. p. 60.

Badghis: 118, March 9, 1885.

Common from Bala-morghab to Gulran, throughout the whole of the Badghis.

NIGELLA INTEGRIFOLIA, Regel in Suppl. 2 ad Enum. Pl. Semenov. p. 10; Bull. Soc. Nat. Mosc. xliii. (1870), p. 246. (Plate II.) Folia superiora tantum indivisa, caulina sessilia, sæpissime ad basin tripartita vel suprema interdum quinquepartita.

Nigella diversifolia, Franchet (in Ann. Sc. Nat. 6ème série, xv. p. 9, t. 10), is very near, if not the same as *N. integrifolia*, Regel.

Hari-rud valley: May 10, 14, 1885; Badghis: 372, May 1, 1885. A small, weak, erect annual, with light blue flowers, that are much hidden in the deeply cleft bracts; occurs singly all over the shingly plains.

DELPHINIUM PERSICUM, Boiss.; Fl. Or. i. p. 76, et var. floribus numerosissimis.

Hari-rud valley: 1002, May 26, 1885, June 4, 1885; 1001, May 10, 1885.

Common on the shingly plains.

DELPHINIUM RUGULOSUM, Boiss.; Boiss. Fl. Or. i. p. 76.

Hari-rud valley: 310, April 25, 1885; April 27, May 11, 1885.

On the shingly plains everywhere. Flowers from greenish to pure white, and often tipped with purple.

DELPHINIUM ORIENTALE, J. Gay; Boiss. Fl. Or. i. p. 79.

Hari-rud valley: 233, April 13, 1885; 444, May 11, 1885.

Occurs commonly in the open country, as well as in corn-fields, where it is a much taller and more erect plant.

DELPHINIUM (§ DELPHINASTRUM) ZALIL, Aitch. et Hemsl., n. sp. (Plate III.) *Herba* perennis, erecta, 1–2-pedalis, primum leviter puberula cito glabrescens, caulibus simplicibus vel pauci-ramosis pallidis subnitidis striatulis. *Folia* gracilia, inferiora longe petiolata, petiolis superiorum gradatim brevioribus, omnia ternatipartita, sæpius triternatipartita vel divisione intermedia interdum pinnatipartita, 3–4 poll. diametro, segmentis linearibus rigidis. *Flores* lutei, extus glabri, laxiuscule racemosi, circiter 1 poll. diametro, pedicellis antice pubescentibus; calcar apice attenuatum, sepalis æquans; sepala lata; petala angusta, bifida, intus leviter pilosa vel barbata; filamenta dilatata, superne leviter pilosula; gynæcium glabrum. *Folliculi* 3, oblongi, glabri, longitudinaliter 5-costati, inter costas distanter reticulati; semina oblonga, subquadrata, transversim eleganter fimbriato-lamellata.

Allied to *D. ochroleucum*, Stev., but differing in its more finely cut leaves, much looser racemes, glabrous flowers, pedicels densely pubescent below, and short, strongly ribbed follicles. Dr. Regel, to whom we submitted two or three flowers and a leaf, thought it might be *D. ochroleuca*.

Khorasan: 671, June 17, 1885; July 4, 1885.

Native name *Zalil*. This plant forms a great portion of the herbage of the rolling downs of the Badghis; in the vicinity of Gulran it was in great abundance, and when in blossom gave a wondrous golden hue to the pastures; in many localities in Khorasan above 3000 feet altitude it is equally common. The flowers are collected largely for exportation, chiefly to Persia, for dyeing silk; they are also exported from Herat through Afghanistan to Northern India, to be employed as a dye, as well as to be used in medicine.

BERBERIDEÆ.

Berberis vulgaris, Linn.; Boiss. Fl. Or. i. p. 102.

Khorasan; 650, June 16, 18, 1885.

Native name *Zihr-bar*.

Common at an altitude above 3000 feet, near water, in Khorasan, and on the Paropamisus range. The edible fruit is collected for sale in the markets.

Bongardia Rauwolfii, C. A. Mey.—*Bongardia chrysogonum*, Boiss. Fl. Or. i. p. 99.

Hari-rud valley: 145, April 1, 1885.

Very common in the loamy sandy soil of the Badghis near Gulran.

Leontice leontopetalum, Linn.; Boiss. Fl. Or. i. p. 99.

Badghis: 130, March 18, 1885; Hari-rud valley, April 6, 10, 21, 1885.

Occurs everywhere, in sandy loam. It has large curiously irregular-shaped root-stocks, which are deeply buried in the soil.

Leontice leontopetalum, Linn.; var.? floribus viridi-luteis minoribus.

Badghis: 1003, March 19, 1885.

This is a dwarf plant, growing in pure sand; the petals strongly veined, the lower bracts more divided, and the flowers more green than yellow.

PAPAVERACEÆ.

Papaver dubium, var. lævigatum, Elk.—*Papaver lævigatum*, Bieb.; Boiss. Fl. Or. i. p. 114.

Hari-rud valley: 271, April 19, 1885. Very common in soft soil.

Papaver somniferum, Linn.; Boiss. Fl. Or. i. p. 116.

Native name *Khok-nar*.

Cultivated: on a small scale in the Hari-rud valley; largely in Khorasan.

Papaver pavoninum, C. A. Mey.; Boiss. Fl. Or. i. p. 116.

Hari-rud valley: 269, April 18, 19, 21, 26, 1885; and Badghis.

Native name *Gul-i-dukhter*.

In abundance over the whole country; when in flower brightens the landscape with its brilliant colouring.

Glaucium fimbrilligerum, Boiss.; Boiss. Fl. Or. i. p. 120.

Hari-rud valley: 272, April 19, 1885; Badghis, May 1, 1885.

Profuse on stony ground.

Rœmeria hybrida, DC.; Boiss. Fl. Or. i. p. 118.

Hari-rud valley: 209, April 1885.

Native name *Shatira*. Very common throughout the country traversed; flowers deep claret, drying to an inky blue.

Rœmeria rhœadiflora, Boiss.; Boiss. Fl. Or. i. p. 119.

Badghis: 1004, May 1, 1885; and Hari-rud valley.

In large quantity everywhere, with *Papaver pavoninum*; when in full blossom colours the country bright red.

Hypecoum procumbens, Linn.; Boiss. Fl. Or. i. p. 124.

Hari-rud valley: 158, April 6, 1885.

In shaded situations, and also in cultivated ground; common.

Corydalis Sewerzovi, Regel, Pl. Semenov. fasc. i. Suppl. ii. p. 16. n. 606; Gartenflora, vol. xxxi. (1882), p. 97, t. 1077; Bot. Mag. vol. cxii. tab. 6896 (1886).

Badghis: 122, March 12, 18, 1885.

At the base of sandstone rocks, at an altitude of 3000 feet; frequent, but local.

Fumaria parviflora, Lam.; Boiss. Fl. Or. i. p. 135.

Hari-rud valley: 216, April 13, 1885. Generally distributed over the whole country.

CRUCIFERÆ.

Mathiola albicaulis, Boiss.; Boiss. Fl. Or. i. p. 147.

Badghis: 337, April 29, 1885; May 2, 19, 1885.

On the ridges of low sandstone hills, at an altitude of 3000 feet, frequent. A very handsome perennial, throwing up annual, erect, almost woody shoots up to 3 feet in height, and ending in a lax spike of purplish or occasionally light greenish-yellow flowers.

Mathiola chenopodifolia, Fisch. et Mey.; Boiss. Fl. Or. i. p. 153.

Hari-rud valley: 294, April 21, 1885; May 13, 1885; 278, April 19, 1885.

Common in stony ground.

Mathiola odoratissima, R. Br.; Boiss. Fl. Or. i. p. 149 (*Hesperis*, Poir.).

Hari-rud valley: 212, April 13, 1885. Near Khusan, not common.

Mathiola, sp.

Badghis: 514, May 19, 1885.

Common at an altitude of 3000 feet, on stony soil. A perennial, about a foot in height, with numerous annual shoots that become woody and remain on the stem into the following year. The flowers are few, smoke-coloured, and the petals twisted.

Diptychocarpus strictus, Boiss. Fl. Or. i. p. 145 (*Alloceratium*, Hook. f. et Thoms.).

Hari-rud valley: 205, April 11, 17, 29, 1885; 242, April 15, 1885. Common.

Cithareloma Lehmanni, Bunge; Boiss. Fl. Or. i. p. 238.

Northern Baluchistan: 13, Sept. 30, 1884. Between Nushki and Sanduri in the desert. Only one specimen obtained.

Barbarea vulgaris, R. Br.; Boiss. Fl. Or. i. p. 183.

Paropamisus range: 552, May 24, 1885. On the Kohtal-pangi pass, in moist meadow-land, at an altitude of 3500 feet and upwards. Eaten raw by the natives.

Arabis ? sp.

Hari-rud valley: 185, April 7, 1885; 260, April 16, 1885. A very common plant, growing in dense clusters amongst stones and gravel, on hill-sides. Flowers minute, white.

Alyssum campestre, Linn.; Boiss. Fl. Or. i. p. 283.

Hari-rud valley: 194, April 6, 7, 17, 26, 1885; Khorasan, June 17, 1885.

Frequent in dry stony places.

Alyssum linifolium, Steph.; Boiss. Fl. Or. i. p. 286 (*Meniocus*, DC. Syst. ii. p. 325).

Hari-rud valley: 160, April 6, 19, 1885; 403, May 9, 1885.

In the shade under bushes, very common.

Alyssum persicum, Boiss. Fl. Or. i. p. 279.

Paropamisus range: 394, May 5, 1885; Khorasan: 680, June 18, 1885.

On the Chashma-sabz pass, and on the pass above Bezd, at an altitude of 5000 feet; growing in large clusters.

Erophila vulgaris, DC.; Boiss. Fl. Or. i. p. 304.—*Draba verna*, Linn.

Badghis: 140, March 24, 1885; 1154, May 1, 1885.

There are two forms of this very variable plant; 140 is very minute, whereas 1154 is from four to six inches high. Very common in moist gravelly soil, in the vicinity of streams.

Malcolmia africana, R. Br.; Boiss. Fl. Or. i. p. 223.

Hari-rud valley: 178, April 6, 1885; 186, April 7, 1885. Common everywhere.

MALCOLMIA CABULICA, Hook. f. et Thoms.; Boiss. Fl. Or. i. p. 224 (*Strigosella*, Boiss. Diag. ii. 1. p. 22).

Hari-rud valley: 1005, April 10, 1885.

MALCOLMIA INTERMEDIA, C. A. Mey.; *Malcolmia africana*, R. Br.; var. *β. intermedia*, Boiss. Fl. Or. i. p. 223.

Hari-rud valley: 187, April 7, 1885. In abundance; but usually found under the shade of bushes.

MALCOLMIA BUNGEI, Boiss. Fl. Or. i. p. 226, var. *β. glabrescens.—Malcolmia circinnata*, Hook. f. et Thoms., non Bunge.

Hari-rud valley: 177, April 6, 1885; 302, April 21, 1885; and April 11, 17, 26, 1885; May 10, 1885. In great abundance, in a gravelly soil. When in flower it gives a bright colour to the country.

MALCOLMIA, sp.

Hari-rud valley: 1006, April 17, 1885.

SISYMBRIUM PUMILUM, Steph.; Boiss. Fl. Or. i. p. 213.

Hari-rud valley: 163, April 6, 1885; 189, April 7, 1885; April 2, 17, 1885.
In the shade of shrubs, very common.

SISYMBRIUM HIMALAICUM, Hook. f. et Thoms.; Hook. f. Flora British India, i. p. 147.

Badghis: 519, May 4, 20, 1885. In sandy soil, common.

SISYMBRIUM WALLICHII, Hook. f. et Thoms.; Boiss. Fl. Or. i. p. 215.

Khorasan: 1008, June 6, 1885.
The only specimen was collected in the gorge above Bezd, at an altitude of about 3000 ft.

SISYMBRIUM SOPHIA, Linn.; Boiss. Fl. Or. i. p. 216.

Hari-rud valley: 218, April 13, 1885.
In abundance all over the country; varying very greatly in size.

SISYMBRIUM, sp.

Hari-rud valley: 240, April 15, 19, 1885. No ripe fruit for identifying the species. A spreading annual from 4 inches to 1 foot in height, with rather large white or pink flowers; general over the country, in gravelly and stony soil.

SISYMBRIUM, sp.

Hari-rud valley: 161, April 6, 1885. Without ripe fruit. A weak spreading annual, from 4 to 6 inches in height; flowers small, pinkish or white; frequent near shrubs.

SISYMBRIUM, sp.

Hari-rud valley: 222, 232, April 13, 16, 1885. On the borders of fields and near villages; common. An erect annual, with numerous spreading branches, from 1 foot to 3 feet in height; lower leaves over 6 inches in length, deeply pinnate with the lobes broadly toothed; the upper leaves with almost linear lobes. Flowers yellow, very large; no ripe fruit. It is closely allied to *S. pannonicum.*

CONRINGIA CLAVATA, Boiss. Fl. Or. i. p. 211.

Hari-rud valley: 346, April 29, 1885. Abundant all over the country. Dyes the hands yellow-green when bruised or broken.

ERYSIMUM PERSEPOLITANUM, Boiss. Fl. Or. i. p. 203.

Khorasan: 687, June 18, 1885. Abundant on the pass south of Bezd, above 6000 feet.

ERYSIMUM REPANDUM, Linn.; Boiss. Fl. Or. i. p. 189.

Hari-rud valley: 195, April 7, 19, 1885. Very common, in the shade of bushes in sandy soil.

ERYSIMUM SISYMBRIOIDES, C. A. Mey.; Boiss. Fl. Or. i. p. 188.

Hari-rud valley?: 1009. In fruit only. No locality nor date. A characteristic plant of Central Asia.

ERYSIMUM, sp.

Hari-rud valley: 153, April 2, 1885; Badghis, May 3, 1885. In sandy plains; Gulran, profuse.

No ripe fruit for determination; nearly allied to *E. canescens*, Benth.

ERYSIMUM, sp.

Hari-rud valley: 298, April 21, 1885.

A tall, much branched perennial, about two feet in height. Common in sandy loamy soil, in open plains; very showy when in full flower; flowers large, bright yellow.

LEPTALEUM FILIFOLIUM, DC.; Boiss. Fl. Or. i. p. 213 (*L. pygmæum*, DC.).

Hari-rud valley: 159, April 6, 21, 1885; May 9, 1885.

Abundant in shingly places. Flowers the colour of those of *Geranium lucidum*, Linn.

CAMELINA SATIVA, Crantz; Boiss. Fl. Or. i. p. 311.

Badghis: 392, May 4, 1885. On sandy downs, in abundance. It is not cultivated, so far as I could find out, in Afghanistan.

BRASSICA CAMPESTRIS, Linn.—Subsp. *Napus*, Linn. (sp.); Boiss. Fl. Or. i. p. 392.

Hari-rud valley: 1010, May 11, 1885. Rape; native name *Shersham.* Cultivated in fields for the oil extracted from its seeds, but only of late years to any great extent.

BRASSICA CAMPESTRIS, Linn.—Subsp. *Rapa*, Linn. (sp.); Boiss. Fl. Or. i. p. 391.

Hari-rud valley: 244, April 16, 1885.

The Turnip. Native name *Shalgham.* Extensively cultivated throughout Afghanistan and Persia. At Khusan, in a garden where the cultivator had only a few seeds left from last year, he told me he sowed the seed in spring from which, in May, he would obtain a good crop of seed (from these my specimens were collected); this he would sow in autumn, and this sowing would produce his winter crop of turnips.

Brassica, sp.

Hari-rud valley: 276, April 17, 19, 27, 1885. Native name *Gul-zard.* Common throughout the valley on stony soil, but especially near sheepfolds.

A coarse annual, from one to three feet in height, with numerous branches covered more or less densely with long white hairs.

Brassica, sp.

Hari-rud: 1011, April, 10, 1885. A small annual species; leaves glaucous; no fruit. We were unable to match it.

Eruca sativa, Lam.; Boiss. Fl. Or. i. p. 396.

Hari-rud valley: 225, 261, April 13, 16, 1885; Khorasan: June 5, 1885. Native name *Mandao.* Cultivated largely, both in Afghanistan and Persia, for its seed, from which oil is extracted.

Lepidium Aucheri, Boiss. Fl. Or. i. p. 354.

Hari-rud valley: 451, May 12, 1885; June 6, 1885. In abundance where rain-water had accumulated in shallow pools on a clay deposit, forming a dense sward closely appressed to the ground.

Lepidium latifolium, Linn.; Boiss. Fl. Or. i. p. 359.

Hari-rud valley: 607, June 5, 1885. This widely-spread coarse weed was not uncommon near villages and cultivation.

Lepidium Draba, Linn.; Boiss. Fl. Or. i. p. 356.

Hari-rud valley: 315, April 25, 1885. Native name *Bijindak.* Profuse near villages and in cultivated land; a common corn-weed. The leaves are collected and eaten as a pot-herb.

Lepidium crassifolium, Waldst. & Kit.; Boiss. Fl. Or. i. p. 357.

Hari-rud valley?: 1012. No locality nor date attached to the specimen of this remarkable thick-leaved plant.

Lepidium perfoliatum, Linn.; Boiss. Fl. Or. i. p. 362.

Hari-rud valley: 284, April 12, 19, 1885. Abundant in lands from which the river had retired in spring. A very pretty and curious species, remarkable for the two very different forms of leaves it bears.

Æthionema cristatum, DC.; Boiss. Fl. Or. i. p. 352.

Hari-rud valley: 280, April 13, 19, 1885; Badghis: May 1, 16, 1885.

A small annual species which is not common, or else it is very easily overlooked.

Heldreichia longifolia, Boiss. Fl. Or. i. p. 319.

Badghis: 516, May 19, 1885; Mt. Do-shakh: August 5, 1885. A remarkable plant, with numerous slender twiggy flowering stems rising from a tuft of plantain-like leaves, Flowers white.

CLYPEOLA DICHOTOMA, Boiss. in Ann. Sc. Nat. 2^{me} série, xvii. p. 175; Fl. Or. i. p. 310.
Hari-rud valley: 1155, April 19, 27, 1885.

ISATIS MINIMA, Bunge; Boiss. Fl. Or. i. p. 383.
Hari-rud valley: 238, April 15, 18, 1885; 304, April 21, 1885. In land from which the river had retired after floods, where it was quite common.

ISATIS ARMENA, Linn.—*Sameraria armena*, Desv.; Boiss. Fl. Or. i. p. 375.
Hari-rud valley: 181, April 7, 19, 1885. Common. A conspicuous plant when in fruit, which is covered with a white felt and subtended by the persistent ruddy sepals.

ISATIS BOISSIERIANA, Reichb. f. in Trimen's Journal of Botany, xiv. 1876, p. 46.
Hari-rud valley: 227, April 13, 1885. Common, in cultivated land.

I also collected a specimen in young fruit of another species of *Isatis*: Hari-rud valley: 1013, April 17, 1885.

ISATIS BULLATA, Aitch. et Hemsl., n. sp. *Herba* annua vel saltem monocarpica, erecta, 1½–2-pedalis, undique glaberrima, caule basi simplici. *Folia* inferiora desunt, caulina crassiuscula, sessilia, amplexicaulia, oblonga, 1½–4 poll. longa, apice rotundata, sinuata, auriculis obtusissimis. *Flores* flavi, laxe racemosi, pedicellis filiformibus, fructiferis arcte recurvis. *Siliculæ* maturæ fere crustaceæ, ovatæ, 8–9 lineas longæ, stylo brevi coronatæ, circumalatæ, prominenter pauci-venosæ, inter venas depressæ.
Badghis: 1014, May 4, 1885. Common on the sandy downs of Gulran.

PACHYPTERYGIUM HETEROTRICHUM, Bunge; Boiss. Fl. Or. i. p. 374.
Paropamisus range: 565, May 1885. Between the Kohtal-sangi pass and Danasanjiti, at an altitude of about 4000 feet. Only two or three plants seen.

NESLIA PANICULATA, Desv.; Boiss. Fl. Or. i. p. 371.
Hari-rud valley: 219, April 13, 1885. Very common in cultivated land and amongst corn.

EUCLIDIUM SYRIACUM, R. Br.; Boiss. Fl. Or. i. p. 368.
Hari-rud valley: 188, April 7, 11, 1885. On stony ground, not common.

CRAMBE CORDIFOLIA, Stev.; Boiss. Fl. Or. i. p. 405. (Plate IV.)
Hari-rud valley: 344, April 29, 1885; Badghis, May 19, 1885. Native names: *Tetran, Tatran, Taturan, Tatera, Thatrang*. A very coarse-growing perennial, with an underground root-stock, somewhat resembling an elongated Swedish turnip, from a foot to eighteen inches in length, and from six to eight inches in circumference. From this root-stock, annual shoots are thrown up from three to four feet in height, bearing great masses of sweetly scented flowers.

This plant is extensively spread all over the Badghis, and, no doubt owing to the rich sandy loam in which it is found, it produces the large turnip-like root-stocks, which are collected and stored by the Turkomans for feeding their camels on during winter.

Goldbachia lævigata, DC.; Boiss. Fl. Or. i. p. 243.

Hari-rud valley: 162, April 6, 1885; 176, June 4, 1885. Common in loamy soil.

Goldbachia torulosa, DC.—*Goldbachia lævigata*, DC., var. β. Boiss. Fl. Or. i. p. 243.

Hari-rud valley: 1015, May 9, 1885. Our plant is identical with no. 1255 of the Karelin and Kiriloff collection in the Kew Herbarium, which, in my opinion, is distinct, as a species, from *G. lævigata*.

Chorispora tenella, DC.; Boiss. Fl. Or. i. p. 143.

Hari-rud valley: 1016, April 7, 1885. In the shade of shrubs; very common.

Chorispora, sp.

Hari-rud valley: 148, April 2, 1885. Collected at the Chashma-sabz spring; too young for identification, though perhaps a young state of *C. tenella*.

CAPPARIDEÆ.

Cleome coluteoides, Boiss. Diagn. ser. 1, i. p. 3.—*Buhsea coluteoides*, Boiss. Fl. Or. i. p. 416.

Hari-rud valley: 165, April 6, 15, 21, 1885; May 10, 1885. Also frequent in Khorasan. A perennial, with large underground root-stocks, from which numerous annual stems, one to two feet high, are thrown up, forming a thick, close bush, conspicuous from the purplish colour of the flowers and the large inflated pods. An exceedingly nasty odour is given out from the crushed leaves.

Capparis spinosa, Linn.; Boiss. Fl. Or. i. p. 420.

Baluchistan: Oct. 20, 1884; Badghis: May 19, 1885; Hari-rud valley: 590, June 3, 1885, July 30, 1885. Native name, *Kha-warg.* One of the few shrubs which extends from Northern Baluchistan, along the Helmand and the Hari-rud valley, to Bala-morghab and in Khorasan. Over all this country it grows in the open, and is a pest to the cultivator, as it seems to prefer cultivated fields. On the banks of the Helmand it grew very like a Bramble, and was often seen as a large scrambling bush six feet in height. The natives eat the fruit, and camels are very fond of browsing on the branches.

RESEDACEÆ.

Reseda luteola, Linn.; Boiss. Fl. Or. i. p. 434.

Hari-rud valley: 633, June 15, 1885; Badghis: 529, May 21, 1885.

Generally over the country, and common as a field-weed.

Reseda Aucheri, Boiss. Fl. Or. i. p. 434.

Hari-rud valley: 291, April 21, 1885; 420, May 10, 1885, June 4, 1885.

A tall handsome perennial; common in stony ground and amongst shingle.

FRANKENIACEÆ.

FRANKENIA PULVERULENTA, Linn.; Boiss. Fl. Or. i. p. 779.

Hari-rud valley?: 1017 (1885).

To these specimens there was no locality nor date attached; they were certainly collected during 1885, and probably in the Hari-rud valley.

FRANKENIA LÆVIS, Linn.—*Frankenia hirsuta*, Linn., var. α. *lævis*, Boiss. Fl. Or. i. p. 780.

Hari-rud valley: 581, May 28, 1885; 747, July 29, 1885; Khorasan: August 18, 85. In saline soil, very common.

CARYOPHYLLEÆ.

DIANTHUS CRINITUS, Smith; Boiss. Fl. Or. i. p. 496.

Khorasan: 715, July 19, 1885. On stony ground, above an altitude of 3000 feet; in quantity near Bezd.

DIANTHUS FIMBRIATUS, Bieb., var., Boiss. Fl. Or. i. p. 495.

Hari-rud valley: 1018, August 3, 1885. At the base of Mount Do-shakh; common.

ACANTHOPHYLLUM MACRODON, Edgew.; Hook. f. Fl. British India, i. p. 216.

Khorasan: 673, June 17, 1885. Native name *Behk.* Growing at an altitude of above 5000 feet, it occurs in dense hummocks, fully four feet in depth, and from six to twelve feet across. The stems and root-stocks are collected and sold in the markets, being employed in lieu of soap for washing clothes, wool, &c.

ACANTHOPHYLLUM SORDIDUM, Bunge; Boiss. Fl. Or. i. p. 565.

Khorasan: 1020, June 22, 1885. Forming very loose small hummocks, occurring singly or in pairs, in stony soil in the Badghis, Hari-rud, and Khorasan; the flowers very inconspicuous when compared with those of the other species met with. Bunge's typical specimens are less vigorous, and the only one we have seen has no perfect petals; yet we have little doubt of the correctness of this identification.

ACANTHOPHYLLUM SQUARROSUM, Boiss. Fl. Or. i. p. 562 (varietates).

Hari-rud valley: 575, May 28, 1885; 1021, 1885.

A spinous shrub, forming loose hummocks, bearing a very conspicuous inflorescence of white or rose-coloured flowers, appearing like large natural bouquets; it is characteristic of the boulder and gravel country.

ACANTHOPHYLLUM SQUARROSUM, Boiss. Fl. Or. i. p. 565, forma nana.

Hari-rud valley: May 27, 1885; Badghis: 475, May 16, 1885.

This forms small, dense, tight pillows or hummocks, with a great profusion of flowers over the whole surface, varying in colour from white to almost red. Associated with the ordinary form in the boulder and gravel country.

A. squarrosum, Boiss., is a very variable species, having a wide range, and should probably include *A. pungens*, Boiss., and *A. elatius*, Bunge.

GYPSOPHILA PANICULATA, Linn.; Boiss. Fl. Or. i. p. 542.

Badghis: 389, May 3, 16, 21, 1885; Khorasan, June 15, 1885. Native name *Saosafed*; the root, *Behk.* A shrubby plant, three or four feet in height, consisting of numerous annual stems springing from perennial underground root-stocks. These underground woody stems are collected and employed as soap. A characteristic plant of the sandy loamy districts; in Khorasan a weed in cultivated ground.

GYPSOPHILA ALSINOIDES, Bunge; Boiss. Fl. Or. i. p. 549.

Badghis: 520, May 19, 20, 1885; Hari-rud valley: 576, May 28, 1885.
In sandy soil, frequent.

GYPSOPHILA PORRIGENS, Boiss. Fl. Or. i. p. 557, syn. *Saponaria porrigens*, Linn. Mant. p. 239.

Badghis: 506, May 18, 1885. Amongst grass and other herbage; common.

SAPONARIA VACCARIA, Linn.; Boiss. Fl. Or. i. p. 525, syn. *Gypsophila Vaccaria*, Fl. Græc. t. 380.

Hari-rud valley: 456, May 12, 1885. A common weed in cultivated land and amongst corn.

SILENE CONOIDEA, Linn.; Boiss. Fl. Or. i. p. 580.

Hari-rud valley: 1022, April 25, 1885. Common in the open plains, and also a field-weed, as in the Punjab.

SILENE CONIFLORA, Nees; Boiss. Fl. Or. i. p. 578, syn. *Silene acarpophora*, Griseb. Spic. i. p. 172.

Hari-rud valley: 214, 279, April 13, 19, 1885. Common, in good soil, in the shade of shrubs.

SILENE, sp.

Hari-rud valley: 170, April 6, 12, 15, 17, 1885. An annual, from 4 to 5 inches in height, branching from the base; petals slightly protruding beyond the calyx, lemon-colour. In sandy soil, close to the base of large shrubs, frequent.

SILENE, sp. aff. *S. leyseroidei*, Boiss.

Hari-rud valley: 1023, 1885.

LYCHNIS VESPERTINA, Sibth.—*Melandrium pratense*, Roehl.; Boiss. Fl. Or. i. p. 660.

Khorasan; 647, June 16, 18, 1885. On banks of stream near Bezd; in abundance. A tall straggling perennial, diœcious, with white flowers.

LYCHNIS, sp.

Persia: 1024, Oct. 1885. On the descent to Asterabad, in clefts of limestone rock, forming moss-like masses, covered with a profusion of large brilliant-coloured flowers. Seed sent to Kew.

HOLOSTEUM UMBELLATUM, Linn.; Boiss. Fl. Or. i. p. 709.

Hari-rud valley: 167, April 6, 7, 13, 15, 1885; Badghis: 376, May 1, 1885. In quantity under the shade of rocks.

Cerastium dichotomum, Linn.; Boiss. Fl. Or. i. p. 721.

Badghis: 358, May 1, 1885. Occasional, in shady places. This very distinct species extends westward to Spain.

Stellaria Kotschyana, Fenzl; Boiss. Fl. Or. i. p. 705.

Khorasan: 655, June 16, 1885. At an altitude of above 5000 feet; in shady places, amongst stones, common.

Arenaria tenuifolia, Linn., var.; Boiss. Fl. Or. i. p. 685.

Locality unknown: 1025 (1885).

Arenaria holosteoides, Edgew.; Hook. f. Fl. British India, i. p. 241.—*Lepyrodiclis holosteoides*, Fenzl; Boiss. Fl. Or. i. p. 668.

Hari-rud valley: 229, April 13, 25, 1885, May 11, 1885; Khorasan: June 16, 1885. Native name *Gandam-ak*. A profuse weed in cultivated ground, especially amongst corn.

Arenaria Meyeri, Boiss. Fl. Or. i. p. 682.

No locality given: 1026 (1885).

Arenaria serpyllifolia, Linn.; Boiss. Fl. Or. i. p. 701 (incl. *A. leptoclados*, Reichb.).

Badghis: 361, May 1, 1885; 493, May 17, 1885. Under the shade of large rocks; scarce.

Buffonia macrocarpa, Ser.; Boiss. Fl. Or. i. p. 667.

Hari-rud valley: 599, June 4, 1885, July 28, 1885. In stony rocky ground; not uncommon. From a woody root-stock a dense mass of annual stems spring, about 18 inches in height; in general appearance very much resembling a clump of *Linum*, only stiffer.

Spergularia diandra, Boiss. Fl. Or. i. p. 733.

Hari-rud valley: 1027 (1885).

In stony places, near Khusan.

TAMARISCINEÆ.

Tamarix tetranda, Pall.; Boiss. Fl. Or. i. p. 769, var.?

Hari-rud valley: 285, April 19, 1885, 286, April 19, 1885, 296, April 21, 1885; Badghis: May 1, 4, 1885. This species is nearly allied to *T. parviflora*, DC. It is a shrub, sometimes as much as twelve feet in height, occurring on islands in the river, in stream-beds, and on the banks of streams throughout the Hari-rud valley, and over the whole of the Badghis. Native name *Gaz*, a term applied generically to several species; the wood forms excellent fuel.

Tamarix Pallasii, Desv.; Boiss. Fl. Or. i. p. 773.

Hari-rud valley: 1028, August 6, 1885, June 4, 1885. On sides of water-courses; common.

Tamarix tetragyna, Ehrenb.; Boiss. Fl. Or. i. p. 768.

Hari-rud valley: May 7, 1885; Badghis; 391, May 4, 1885.

Native name *Gaz-shora*. A small graceful tree on the islands of the Hari-rud, and in the Badghis near water. It is very conspicuous from the vivid green of its foliage, and its long pendulous spikes of pure white flowers.

TAMARIX MACROCARPA, Bunge; Boiss. Fl. Or. i. p. 779.

Northern Baluchistan: 32, October 3, 11, 1884. Native names *Kirri* and *Gaz-surkh*; the latter term is applied to this shrub owing to the bright red colour of the bark. It is a very common large shrub throughout Northern Baluchistan, in many places forming thickets. At Omar-sha there were several trees, six feet in circumference, of this species, but all cultivated and carefully protected.

TAMARIX GALLICA, Linn., var. MANNIFERA, Ehrenb. in Linnæa, 1827, p. 270.—*Tamarix mannifera*, Bunge, Tent. Tam. Sp. p. 63; Boiss. Fl. Or. i. p. 775.

Badghis: 1029, May 18, 1885. This was pointed out to me by a native of Kerman, in Persia, as being the Tamarisk that yielded a manna in that district, and there called *Gaz shakar*.

TAMARIX GALLICA, Linn., var.; Hook. f. Flora British India, i. p. 248.

Badghis: 1030, May 18, 1885. Native name *Gaz-surkh*; generally spread throughout the Hari-rud valley and Badghis; also common in Baluchistan, where it is called *Gaz-khera*, and where the wands of this shrub are largely employed in all sorts of basket-work. A Tamarisk which I believe to be the above species is called by the natives *Gaz-mazu*, owing to its yielding a gall; and from the stems of this are manufactured handles for whips.

TAMARIX ARTICULATA, Vahl; Boiss. Fl. Or. i. p. 777.

Northern Baluchistan: 31, October 3, 1884. Native name *Kirri*. At Omar-sha were several cultivated trees of this species, from 6 to 9 feet in circumference, and 40 feet high. On the Helmand this species is indigenous, and occurs as a large tree, characteristically growing on mounds, and hence called by the natives *Kohr-a-gaz*. I measured one tree which was 15 feet in circumference.

REAUMURIA HYPERICOIDES, Willd.; Boiss. Fl. Or. i. p. 761.

Hari-rud valley: 1032 (608_2). June 6, 1885.

REAUMURIA HYPERICOIDES, Willd., var. β. LATIFOLIA, Bieb.; Boiss. Fl. Or. i. p. 761.

Hari-rud valley: 608, June 6, 1885; July 28, 1885. On slopes of hill-sides, in gravelly soil; common.

HYPERICINEÆ.

HYPERICUM SCABRUM, Linn.; Boiss. Fl. Or. i. p. 796.

Badghis: 526, May 21, 1885; Khorasan: June 18, 1885.

On the margin of streams, above 3000 feet altitude; not uncommon in gravelly soil.

HYPERICUM HELIANTHEMOIDES, Boiss.; Fl. Or. i. p. 802.

Khorasan: 1033, July 1, 1885.

MALVACEÆ.

Althæa Hohenackeri, Boiss. Fl. Or. i. p. 833.

Khorasan: 713, July 19, 1885; June 17, 1885.

On gravelly plains, above 4000 feet altitude; common. A very showy plant.

Althæa officinalis, Linn.; Boiss. Fl. Or. i. p. 825.

Badghis: 497, May 18, 1885. In loamy soil, near a stream-bed at Chilgaz; and near villages on the Hari-rud, but local; where it occurs it is in some quantity.

Althæa lavateræflora, DC.; Boiss. Fl. Or. i. p. 828.

Hari-rud valley: 584, June 3, 1885. A cultivated plant, on ridges between fields.

Malva sylvestris, Linn.; Boiss. Fl. Or. i. p. 819.

Khorasan: 628, June 15, 1885; July 11, 1885. Native name *Gul-i-Khadmi.* A weed of cultivation; common in gardens and also in fields.

Malva rotundifolia, Linn.; Boiss. Fl. Or. i. p. 820.

Hari-rud valley: 252, April 16, 25, 1885; June 14, 1885. Near cultivation, in stony soil, everywhere.

Hibiscus Trionum, Linn.; Boiss. Fl. Or. i. p. 840, syn. *H. ternatus*, Cav.

Khorasan: 799, August 23, 1885. A weed, in cultivated ground, frequent.

Gossypium herbaceum, Linn.; Hook. f. Flora British India, i. p. 346.

Khorasan: 1034, August 23, 1885. Native name *Goza.* Cultivated throughout Afghanistan and Persia.

ZYGOPHYLLEÆ.

Tribulus alatus, Del., var.—*Tribulus macropterus*, Boiss. Fl. Or. i. pp. 902, 903.

Northern Baluchistan: 35, October 4, 1884. Characteristic of the drifting sand-hills of Baluchistan.

Tribulus terrestris, Linn.; Boiss. Fl. Or. i. p. 902.

Hari-rud valley: 755, August 1, 1885; Khorasan: August 23, 25, 1885. In soft soil, cultivated land, &c., common.

Nitraria Schoberi, Linn.; Boiss. Fl. Or. i. p. 919.

Hari-rud valley: 724, July 27, 1885.

A shrub from four to six feet in height; stems and branches very white, and with its fleshy leaves and spinous branches very like a *Lycium*; flowers pure white, in large cymes; fruit, when ripe, a black-purple fleshy drupe, the size of a large pea. Common near Khusan. One of the few shrubs that is not browsed by camels.

Miltianthus portulacoides, Boiss. Fl. Or. i. p. 916.

Hari-rud valley: 199, April 9–10, 1885; Badghis: May 13, 1885.

Grows in a saline clay soil, on the sides of low hills, that are otherwise quite barren. It has large, spongy, rotting root-stocks, from which the annual flowering shoots spring; the flowers are copper-coloured. The plant has been well named, as its general appearance and fleshy leaves much resemble a *Portulaca.*

Zygophyllum Fabago, Linn.; Boiss. Fl. Or. i. p. 913.

Hari-rud valley: 568, May 26, 1885; July 30, 1885; Khorasan: June 15, 1885; Badghis: 108, Dec. 9, 1884. In waste places round villages and old buildings; very common. Native name *Simang.* The roots crushed and employed to cleanse sores.

Zygophyllum atriplicoides, Fisch. et Mey.; Boiss. Fl. Or. i. p. 911.

Northern Baluchistan: 7, Sept. 27, 1884; Hari-rud valley: 152, April 2, 18, 19, 1885.

Native name *Kich.* This is the characteristic shrub from Quetta to Bala-morghab, although never very numerous, still sufficiently so as to make it a striking object in the most desert places. Its curious fleshy leaves, bright yellow flowers, and large winged fruit always attract attention. No animals browse on it, and its wood is useless for fuel.

Fagonia arabica, Linn.; Boiss. Fl. Or. i. p. 907.

Collected between the Hamun of the Helmand and Zagin, Nov. 5, 1884. Specimen lost.

GERANIACEÆ.

Biebersteinia multifida, DC.; Boiss. Fl. Or. i. p. 899.

Badghis: 144, April 1, 1885; May 1, 20, 1885; Hari-rud, April 29, 1885.

Abundant in sandy loamy soil in the Badghis; has large tuberculated root-stocks.

Geranium rotundifolium, Linn.; Boiss. Fl. Or. i. p. 881.

Badghis: 499, May 18, 1885; Hari-rud valley: June 16, 1885.

Very occasional, in the shade of rocks and bushes.

Geranium collinum, Steph., var. Londesii, Fisch.; Boiss. Fl. Or. i. p. 874.

Khorasan: 684, June 18, 1885.

In moist meadow-lands, along with the species of *Orchis* enumerated below, at an altitude of 5000 feet, near Bezd.

Geranium tuberosum, Linn.; Boiss. Fl. Or. i. p. 873.—Var. Charlesii, Aitch. et Hemsl.; Bot. Mag. t. 6910.

Badghis: 379, May 2, 3, 1885. In the crevices of ledges of limestone and sandstone rocks, at an altitude of 3000 feet, on the north and east sides of the Kambao pass; frequent. A perennial, one to two feet in height, though usually from four to six inches; stems of the larger plants weak and spreading, of the smaller stiff and erect; root-stock consisting of a number of superposed tubers, the lowest usually the largest and about an inch in diameter; lowest stem-leaves on long petioles; flowers rose-coloured, varying a good deal in size; the petals increase in size until they fall off.

Erodium ciconium, Willd.; Boiss. Fl. Or. i. p. 891.

Hari-rud valley: 1036, 281_2, April 21, 1885. Common in the shade of rocks and between boulders.

Erodium cicutarium, L'Hér.; Boiss. Fl. Or. i. p. 890.

Hari-rud valley: 213, April 13, 1885; Badghis: 369, May 1, 1885. Native name *Susan-ak.*

Erodium bryoniæfolium, Boiss. Fl. Or. i. p. 896, cum var. foliis magis incisis.

Hari-rud valley: 281, April 19, 27, 1885; Badghis: 1037, May 16, 1885. In the shade of rocks; common.

RUTACEÆ.

Ruta acutifolia, DC.; *Haplophyllum acutifolium*, Boiss. Fl. Or. i. p. 942.

Badghis: 500, May 4, 18, 1885. A perennial, with annual shoots of about two feet in height, covered with a mass of bright mustard-coloured flowers, which are very sweetly scented. In great luxuriance over the whole country.

Ruta erythræa, Aitch. et Hemsl.—*Haplophyllam erythræum*, Boiss. Fl. Or. i. p. 929.

Hari-rud valley: May 27, 1885. Very common in the low hills, west of the Kohtal-sangi pass.

Ruta (§ Haplophyllum) affinis, Aitch. et Hemsl., n. sp. (Plate V. figs. 1–10.) *Herba* humilis, multicaulis, undique glaberrima, caulibus simplicibus gracilibus adscendentibus. *Folia* subsessilia, anguste lanceolata, oblanceolata vel linearia, obtusa vel subacuta, crassiuscula, inconspicue punctata. *Flores* aurei, laxiuscule corymbosi, distincte pedicellati; calycis segmenta brevia, ovali-oblonga, obtusa; petala ovalia, 3–4 lineas longa; filamenta inappendiculata, imberbia; ovarium breviter stipitatum, 5-loculare, loculis 4–6-ovulatis. *Capsula* tuberculata, introrsum dehiscens, lobis apice gibbosis; semina atra, reniformia, rugulosa.

Hari-rud valley: 406, May 9, 12, 1885; July 28, 1885. This species is nearly allied to *R. erythræa*, differing in its much smaller, quite glabrous flowers, and in having six (or perhaps sometimes four) ovules in each cell. Whether the number of ovules is a constant character remains to be proved; but we doubt it, because we find ten to twelve ovules in each cell in our specimens of *R. pedicellata*, which is described as having six.

Ruta pedicellata, Aitch. et Hemsl.—*Haplophyllum pedicellatum*, Spach; Boiss. Fl. Or. i. p. 925.

Hari-rud valley: 297, April 21, 26, 1885; Badghis: May 21, 1885. On sandstone hills and exposed plains; common. A perennial, with numerous, annual, stiff, erect stems, from a foot to eighteen inches in height, ending in an almost umbellate head of numerous flowers; flowers large, pure yellow, or the corolla deeply coloured externally of a chocolate-brown. This is the same species as Griffith's no. 1261. We find that the cells of the ovary are from 8 to 12, not uniformly 6-ovulate, as described by Boissier; and the young stems are hairy.

Ruta (§ Haplophyllum) rotundifolia, Aitch. et Hemsl., n. sp. (Plate V. figs. 11–16.) *Herba* humilis, multicaulis, fere omnino glaberrima, caulibus simplicibus adscendentibus albidis. *Folia* crassiuscula, distincte nigro-punctata, petiolata vel sessilia, infima rotundata, sursum gradatim angustiora et longiora, margine obscure ciliolata. *Flores* flavo-virentes, dichotome cymosa, centrales sessiles, cæteri breviter pedicellati; sepala parva, obtusa; petala ovali-oblonga, obtusa, glandulosa, primum puberula, sed cito glabrescentia, 2½–3 lineas longa; filamenta ad medium dilatata, barbata; ovarium supra discum sessile, tuberculato-glandulosum, lobis apice gibbosis, loculis 2-ovulatis, ovulis collateralibus. *Capsula* deest.

Hari-rud valley: 457, May 12, 1885. Common in sandy soil. This strongly resembles *R. glaberrima* in general appearance, but the bearded filaments, gibbose ovary, and geminate ovules readily distinguish it.

PEGANUM HARMALA, Linn.; Boiss. Fl. Or. i. p. 917.

Hari-rud valley: 579, May 28, 1885; Northern Baluchistan: 17, Sept. 29, 30, 1884. Native names: *Spand, Spanj, Ispanthan.* A very common shrub over the whole country, from Baluchistan to Bala-morghab. The natives everywhere seem to hold it in some superstitious awe.

TETRADICLIS SALSA, Stev.; Boiss. Fl. Or. i. p. 918.

Hari-rud valley: 332, April 1885. Extremely common in salt spongy soil, growing in dense moss-like clusters, in shade; the fleshy leaves much resemble those of many salsolaceous plants.

RHAMNACEÆ.

ZIZYPHUS VULGARIS, Lam.; Bois. Fl. Or. ii. p. 12.

Khorasan: 748, July 30, 1885. Native name *Anab.* A tree about 20 feet high, largely cultivated in orchards throughout Afghanistan and Persia for its fruit. On the 6th of December, 1884, amongst the hills between Palounda and Karez-darra, I came upon a thicket of this species, which I have no doubt was here indigenous, as it is in Kashmir.

RHAMNUS PERSICA, Boiss. Fl. Or. ii. p. 17.

Khorasan: 654, June 6, 1885; August 21, 1885. A small shrub growing in the clefts of limestone rocks, at an altitude of about 5000 feet; not uncommon.

AMPELIDEÆ.

VITIS VINIFERA, Linn.; Hook. f. Fl. British India, i. p. 652.

Hari-rud valley: 1038, May 12, 1885. Native name *Tak.* The grape-vine largely cultivated in orchards, throughout Afghanistan and Persia, for its fruit, called *Angur.*

SAPINDACEÆ.

STOCKSIA BRAHUICA, Benth.; Hooker's Kew Journal of Botany, v. p. 304 (1853).

Northern Baluchistan: 5, Sept. 27, 1884. A spinous tree or shrub, up to eighteen feet in height, covered in autumn with brilliantly coloured inflated fruit about an inch long and three inches in circumference, which remains hanging on the tree long after the leaves have fallen off. Native name *Koh-tor* or mountain-peach. The area of this extends into Afghanistan as far north as Sang-bar, where I saw it, and in all probability it will be found in North-eastern Persia.

ANACARDIACEÆ.

Rhus Coriaria, Linn.; Boiss. Fl. Or. ii. p. 4.

Khorasan: 632, June 15, 1885; August 23, 1885.

Native name *Samahk, Sumahk.* A small tree, cultivated in orchards for its leaves, which are employed in dyeing and tanning.

Pistacia Terebinthus, Linn., var. **mutica**, Aitch. et Hemsley.—*Pistacia mutica*, Fisch. et Mey.; *Pistacia Khinjuk*, Stocks; *Pistacia cabulica*, Stocks; Boiss. Fl. Or. ii. pp. 6, 7.

Northern Baluchistan: D. 61, October 11, 1884; Mt. Do-shakh: C. 1039, August 5, 1885; B. 1040, August 5, 13, 1885; Khorasan: C. 1039, August 19, 1885; A. 1041, August 19, 1885; E. 790, August 21, 1885.

Native name in Baluchistan *Gwan, Wana, Bana*; Afghanistan and Persia, *Kinjak.* A small tree, from fourteen to twenty feet high, usually met with on low hills of limestone formation; occasionally in small groups, but never so numerously together as to constitute a forest. Camels and goats browse on it. The nuts, though small, are roasted, and the kernels eaten; but usually the kernels are crushed, and from them an oil obtained, which is eaten with food. The leaves are said to be employed in dyeing and tanning, but not the galls. The galls are developed on the margin of the leaf, and are very different in form from those of *Pistacia vera.*

After a careful examination of the large amount of material we had to aid us, we are of opinion that the several forms which have been described as species may all be placed as varieties of *P. Terebinthus*, Linn.

Pistacia vera, Linn.; Boiss. Fl. Or. ii. p. 5.

Badghis: 390, May 3, 4, 14, 21, 1885; Khorasan: 665, June 17, 1885. Native name *Pista.* A small indigenous tree, forming forests, at an altitude of from 3000 feet and upwards, usually on sandstone formation. The country where the forests abound is called *Pistalik*, and these forests are greatly valued for their yield of nuts (*Pista*), as well as for the galls on their leaves (*Boz-ganj*), both of which are articles of commerce, especially the former, which are largely exported to India. It yields a gum-resin (*Shilm-i-pista*), employed in household medicine; and the wood is considered the best fuel that the country produces. The tree is cultivated in orchards in Persia, but apparently not in Afghanistan, at least not in the parts visited by me.

LEGUMINOSÆ.

Trigonella Emodi, Benth.; Hook. f. Flora British India, ii. p. 88.

Badghis: 553, May 24, 1885. Common, above 3000 feet.

Trigonella laxiflora, Aitch. et Baker, n. sp.; caulibus erectis elongatis ramosis obscure pilosis, foliolis obovato-cuneatis emarginatis dentatis, racemis laxissimis 6–12-floris, pedicellis calyce 2–3-plo longioribus, calyce piloso, dentibus deltoideis tubo brevioribus, petalis aureis calyce triplo longioribus, legumine lineari-oblongo, plano tenui glabro 1–3-spermo transversaliter venoso.

Caules graciles, straminei, sesquipedales et ultra. *Stipulæ* parvæ, lanceolatæ, persistentes; petioli inferiores 3–4 lin. longi; foliola 4–6 lin. longa, supra medium 3–4 lin. lata, apice late emarginata, minute mucronata, utrinque viridia, obscure pilosa. *Racemi* copiosi, terminales, longe pedunculati, floriferi 1–1½ poll. longi; pedicelli 2–3 lin. longi, floriferi apice cernui, fructiferi deflexi. *Calyx* 2 lin. longus, tubo campanulato, dentibus deltoideis acutis tubo brevioribus. *Petala* 6 lin. longa. *Fructus* 9–12 lin. longus, medio 2–2½ lin. diam., leviter curvatus, deflexus, venis transversalibus gracilibus obliquis exsculptis, suturis incrassatis.

Ad *T. corniculatam*, Linn., et *T. Emodi*, Benth., magis accedit.

Badghis: 484, May 17, 1886. In great profusion between Sim-koh and Kambao-burj; in dense clumps formed by numerous annual stems springing from a perennial root-stock; stems from one to two feet in height; flowers bright yellow.

TRIGONELLA MONANTHA, C. A. Mey.; Boiss. Fl. Or. ii. p. 77.
Hari-rud valley: 323, April 26, 1885.

TRIGONELLA FŒNUMGRÆCUM, Linn.; Boiss. Fl. Or. ii. p. 71.
Hari-rud valley: 227 (2), April 13, 1885; June 5, 1885. Native name *Shamli.* Cultivated extensively in fields for fodder; and in gardens as a pot-herb. It exists frequently as an escape from cultivation.

TRIGONELLA RADIATA, Boiss. Fl. Or. ii. p. 90, syn. *Medicago radiata,* Linn. Sp. Pl. p. 1096.
Khorasan: 710, July 1, 1885. Only obtained once.

MEDICAGO SATIVA, Linn.; Boiss. Fl. Or. ii. p. 94.
Badghis: 532, May 21, 1885. Native name *Sebist.* In the Badghis, at an altitude above 3000 feet, this plant seems to be indigenous; it is, however, cultivated as fodder for horses, wherever water can be obtained for irrigation.

MEDICAGO GERARDI, Willd.; Boiss. Fl. Or. ii. p. 100.
Badghis: 522, May 20, 1885.

MELILOTUS ARVENSIS, Wallr.—*Melilotus officinalis,* Desr.; Boiss. Fl. Or. ii. p. 109.
Hari-rud valley: 583, June 3, 1885. A common plant in cultivated land.

TRIFOLIUM FRAGIFERUM, Linn.; Boiss. Fl. Or. ii. p. 135; Hook. f. Fl. Brit. Ind. ii. p. 86.
Khorasan: 709, July 1, 1885. On the sides of irrigation channels; common.

TRIFOLIUM RESUPINATUM, Linn.; Boiss. Fl. Or. ii. p. 137.
Hari-rud valley: 752, July 30, 1885. Native name *Shautal.* Only met with this plant under cultivation in fields as fodder for cattle and sheep.

TRIFOLIUM REPENS, Linn.; Boiss. Fl. Or. ii. p. 145.
Khorasan: 1156 (709–2), July 1, 1885.

Very common on the sides of irrigation channels and streams; everywhere above 3000 feet altitude.

LOTUS CORNICULATUS, Linn.; Boiss. Fl. Or. ii. p. 165.
Khorasan: 1042, June 16, 1885; August 20, 1885. At an altitude of above 4000 feet; forming a turf on the sides of streams and irrigation channels.

Lotus tenuifolius, Reichb. var.; Boiss. Fl. Or. ii. p. 166, syn. *L. corniculatus*, var., Linn.
Neither locality nor date: 1043.

Astragalus ammophilus, Kar et Kir.; Boiss. Fl. Or. ii. p. 228.
Hari-rud valley: 322, April 18, 26, 1885; 407, May 9, 1885. In great abundance, in sandy soil, forming soft, mossy turf along with *A. Nawabianus.*

Astragalus (§ Oxyglottis) Nawabianus, Aitch. et Baker, n. sp.—Annua, caule erecto sæpissime simplici, stipulis liberis linearibus, foliolis 9–13 oblongis obtusis, utrinque laxe albo-hispidulis, floribus 6–10 in capitula densa longe pedunculata aggregatis, calyce dense piloso, dentibus linearibus tubo æquilongis vel longioribus, petalis lilacinis, calyce duplo longioribus, legumine oblongo abrupte rostrato biloculari 4-spermo dense piloso.

Caules graciles, erecti, 6–9 lin. longi, sursum tenuiter strigillosi. *Folia* 2–4 poll. longa, foliolis oppositis viridibus 3–4 lin. longis. *Capitula* 1–4, axillaria, omnia longe pedunculata. *Calyx* 1½ lin. longus, pilis albis et nigris elongatis flexuosis dense vestitus. *Carina* 3 lin. longa. *Fructus* 2 lin. longus, stylo persistente abrupte rostratus.

Ad *A. ammophilum* magis accedit. Recedit pilis laxis elongatis, capitulis omnibus longe pedunculatis, dentibus calycinis elongatis, legumine abrupte rostrato.

Hari-rud valley: 1044, April 12, 1885; Badghis: May 14, 1885. A slender annual, about six inches in height, growing in great masses close together so as to form a soft moss-like sward; greedily eaten by horses.

Astragalus tenuirugis, Boiss. Fl. Or. ii. p. 232, syn. *A. corrugatus*, Bert., var.
Hari-rud valley: 132 (2), 264, April 7, 17, 19, 21, 1885. Very common.

Astragalus campylorrhynchus, Fisch. et Mey.; Boiss. Fl. Or. ii. p. 233.
Badghis: 374, May 1, 1885; Hari-rud valley: 404, May 9, 1885.

Astragalus gyzensis, Delile; Boiss. Fl. Or. ii. p. 234, syn. *A. hauarensis*, Boiss.
Hari-rud valley: 410, May 9, 1885. Common, in sandy soil amongst gravel.

Astragalus, sp. aff. *A. trimestri*, Linn.
Hari-rud valley: 1045, May 14, 1885. Common; intermixed with *A. Nawabianus.* Ripe pod wanting for exact determination.

Astragalus, sp. aff. *A. hispidulo*, DC.
Hari-rud valley: 226, April 13, 1885. In cultivated land; one specimen only, and insufficient in this genus for description.

Astragalus (§ Phaca) Stephenianus, Aitch. et Baker, n. sp. Perennis, pilis basifixis, caulibus elongatis breviter pilosis, stipulis parvis liberis lanceolatis, foliolis circiter 30-jugis parvis oblongis obtusis utrinque breviter tenuiter albo-pilosis, racemis multis paucifloris densis axillaribus sessilibus, pedicellis brevibus, calyce piloso pilis albis nigrisque intermixtis, tubo oblongo dentibus linearibus tubo vix

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brevioribus, petalis primum albidis demum purpureo-rubellis calyce duplo longioribus, legumine oblongo parvo piloso biloculari recto 4–6-spermo.

Caules cæspitosi, erecti, pedales vel sesquipedales. *Folia* 3–4 poll. longa, foliolis 3–6 lin. longis. *Racemi* 2–8-flori, ad caulem interdum 15–18, dissiti, ad foliorum axillas sessiles. *Calyx* 4 lin. longus, pilis flexuosis elongatis nigris, vel albis vestitus. *Petala* 8–9 lin. longa. *Fructus* oblongus, 3–4 lin. longus, perfecte bilocularis.

Ad *A. tephrosioidem*, Boiss., magis accedit.

Badghis: 383, May 2, 3, 19, 1885. A perennial, with numerous annual almost erect stems, from one to two feet high, originating from a woody root-stock, and bearing in the axils of the stem-leaves numerous flowers in fascicles; flowers pure white at first, but gradually becoming pink or purplish. Common on the Badghis at 3000 feet altitude.

ASTRAGALUS SIEVERSIANUS, Pall.; Boiss. Fl. Or. ii. p. 273.

Badghis: 544, May 22, 1885. In the vicinity of running streams; not common. Large pods, much resembling cocoons of the silkworm, characterize this species.

ASTRAGALUS PELLITUS, Bunge; Boiss. Fl. Or. ii. p. 279.

Hari-rud valley: 1046, August 8, 1885. In stony ground; common.

ASTRAGALUS BUCHTORMENSIS, Pall.; Bunge, Astragali Sp. Geron. ii. p. 45. no. 200.

Badghis: 380, May 2, 1885; Paropamisus: May 25, 1885.

ASTRAGALUS BUCHTORMENSIS, Pall.; var.?

Hari-rud valley: 156, April 3, 6, 1885; April 21?, 1885. In sandy, gravelly soil; common. Each plant grows much isolated; its leaves grow closely appressed to the ground and spread out; and it has a long fibrous whip-like root two to three feet deep in the soil. These roots are employed in lieu of twine by the shepherds.

ASTRAGALUS (§ MYOBROMA) BARROWIANUS, Aitch. et Baker, n. sp. Perennis, exscapus pilis albis mollibus basifixis, stipulis lanceolatis, foliis longe petiolatis, foliolis circiter 30-jugis parvis oblongis utrinque dense albo-pilosis, racemis laxis paucifloris foliis multo brevioribus, calyce dense albo-piloso dentibus e basi lata linearibus tubo æquilongis, petalis luteis calyce sesquilongioribus, legumine oblongo compresso piloso breviter stipitato uniloculari trispermo intus farcto.

Herba perennis, radice elongato fusiformi. *Petioli* 1½–3 poll. longi; lamina semipedalis et ultra foliolis 3–4 lin. longis. *Racemi* pauciflori, breviter pedunculati, pedicellis cernuis 1½–2 lin. longis, bracteis parvis persistentibus lanceolatis. *Calyx* semipollicaris, tubo oblongo, dentibus e basi deltoidea linearibus. *Corolla* 8–9 lin. longa. *Fructus* 4–6 lin. longus, 2½–3 lin. diam.

Ad *A. buchtormensem*, Pall., arcte accedit.

Badghis: 371, May 1, 4, 20, 1885. Common small bush in the loamy sandy soil of the Badghis; flowers pure white. It affords excellent grazing on the rolling plains.

ASTRAGALUS AUGANUS, Bunge; Boiss. Fl. Or. ii. p. 282.

Badghis: 342, April 29, 1885. Common in the low hills; has very long, fibrous, whip-like roots.

Astragalus (§ Myobroma) Cottonianus, Aitch. et Baker, n. sp. Acaulis, perennis, exscapus, pilis parcis brevibus adpressis albis, stipulis lanceolato-deltoideis, foliis longe petiolatis, foliolis 11–13 orbiculari-cuneatis, pedunculo foliis subæquilongo, racemo laxe elongato, bracteis lanceolatis persistentibus, pedicellis brevibus ascendentibus, calyce vix piloso basi bracteolato dentibus lanceolatis tubo oblongo brevioribus, petalis luteis calyce sesquilongioribus, legumine lineari recurvato uniloculari 4–5-spermo breviter stipitato.

Herba perennis, radice elongato fusiformi. *Petioli* 2–3 poll. longi, pilis adpressis albis dense vestiti. *Lamina* 2–4-pollicaris; foliola 6–9 lin. longa, utrinque viridia, pilis adpressis hispidulis albis tenuiter vestiti. *Pedunculus* 5–6-pollicaris; racemus 3–6-pollicaris, laxe 10–20-florus, pedicellis 1–2 lin. longis. *Calyx* 6–7 lin. longus, pilis paucis sparsis albis vel nigris præditus. *Petala* 10–11 lin. longa. *Fructum* maturum non vidi.

Habitus *A. longiflori*, Pall., et *A. flexi*, Fisch. Recedit racemis foliis conspicue eminentibus, etc.

Badghis: 377, May 2, 4, 1885. In great luxuriance, on the low rocky hill-sides of the Badghis; flowers numerous, large, bright yellow, on long spikes. A very showy plant and one well worthy of cultivation.

Astragalus Gompholobium, Benth.; Bunge, Astragali Sp. Geron. ii. p. 50. no. 218.

Badghis: 343, April 29, May 1, 21, 1885. Very common in the sandy soil of the Badghis. It has very long fibrous whip-like roots; the pods are the size of a grape, inflated and full of liquid, and greedily eaten by the natives, who call them both "grapes" and "melons."

Astragalus, sp. aff. *A. ovino*, Boiss. Fl. Or. ii. p. 288.

Badghis: 1047, May 21, 1885. Not sufficient material for identification. The pods are as large as good-sized gooseberries, and, previous to ripening, largely inflated and full of liquid, like those of *A. Gompholobium*; at this period greatly resembling miniature melons. They are sought for and eaten by the shepherds.

Astragalus gerensis, Boiss. Fl. Or. ii. p. 300.

Khorasan: 694, June 14, 18, 1885. In the arid gravelly plains, not uncommon; characterized by its large pod, ending in a hard woody spine.

Astragalus, sp. aff. *A. viciæfolio*, DC.; Boiss. Fl. Or. ii. p. 252.

Badghis: 1048, May 19, 1885.

Astragalus (§ Hypoglottis) Rawlinsianus, Aitch. et Baker, n. sp. Perennis, pilis mollibus albis basifixis, caule brevi, stipulis lanceolatis, foliis breviter petiolatis, foliolis circiter 12-jugis parvis oblongis utrinque laxe albo-pilosis, pedunculo foliis longiore, racemo denso multifloro subspicato pilis elongatis mollibus albis nigrisque dense vestito, bracteis linearibus, calycis dentibus linearibus tubo oblongo-cylindrico vix brevioribus, petalis violaceis calyce sesquilongioribus, legumine sessili parvo oblongo 4-spermo longe piloso stylo elongato curvato apiculato.

Herba perennis, radice elongato fusiformi, caulibus brevibus erectis cæspitosis dense pilosis. *Petioli* 1–1½ poll. longi; lamina 3–4-pollicaris, foliolis inferioribus 5–6 lin. longis. *Pedunculus* sæpe semipedalis; racemus 1½–2 poll. longus. *Calyx* 4 lin. longus. *Petala* saturate lilacina, 6 lin. longa, inferiora vexillo oblongo-unguiculato 1½–2 lin. breviora. *Fructus* calyci æquilongus, pilis elongatis albis dense vestitus.

Ad *A. Fresenii*, Decne., magis accedit.

Badghis: 357, May 1, 19, 20, 1885. A very common undershrub, reaching a foot in height on the low hills, and forming excellent fodder for sheep and goats. Flowers purple, in heads, and very like clover when young; but the heads gradually increase in length, and by the time the fruit has formed they are often fully four inches long.

ASTRAGALUS (§ CALYCOPHYSA) GRISEBACHIANUS, Aitch. et Baker, n. sp. Perennis, caulibus elongatis angulatis flexuosis pilis albis adpressis vestitis, stipulis herbaceis lanceolatis persistentibus, petiolis inermibus, foliolis 20–25-jugis oblongis mucronatis utrinque dense albo-pilosis, floribus in capitula magna globosa axillaria pedunculata aggregatis, bracteis linearibus, calyce densissime longe albo-villoso dentibus linearibus tubo campanulato longioribus, petalis pallide luteis copiose viridi-venosis calycem vix superantibus, vexillo sericeo petalis reliquis longiore, legumine parvo oblongo turgido biloculari 2-spermo.

Herba perennis, caulibus subpedalibus. *Folia* 6–8 poll. longa, foliolis inferioribus 6–8 lin. longis. *Pedunculi* 1½–2 poll. longi. *Capitula* florifera dense lanosa 2 poll. diam. *Calyx* subpollicaris, dentibus linearibus flexuosis, tubo inflato post anthesin haud rupto; vexillum 4–5 lin. latum. *Fructus* in calycis tubo inclusus.

Ad *A. vulpinum*, Willd., magis accedit.

Hari-rud valley: 419, May 10, 1885; June 4, 1885. Not common, though very striking from its large, globular, greenish-yellow flower-heads.

ASTRAGALUS SCHAHRUDENSIS, Bunge; Boiss. Fl. Or. ii. p. 416.

Khorasan: 669, June 17, 1885. Common in cultivated land, at 5000 feet altitude. Flowers bright yellow.

ASTRAGALUS KAHIRICUS, DC.; Boiss. Fl. Or. ii. p. 420.

Hari-rud valley: 236, April 10, 15, 18, 1885; May 9, 1885. Very common in sandy soil. It has a tough fibrous root three feet in length, which is employed as a substitute for rope by the country people.

ASTRAGALUS CHRYSOSTACHYS, Boiss. Fl. Or. ii. p. 377.

Khorasan: 645, June 16, 1885. Common, at 5000 feet altitude, and forming great hassocks from three to five feet across, and two to three feet deep. When covered, as I saw it, with its great spikes of golden flowers it is a grand sight.

ASTRAGALUS (§ CALYCOPHYSA) LUMSDENIANUS, Aitch. et Baker, n. sp. Herbaceus, perennis, subacaulis, foliis pilis copiosis albis brevibus vestitis, stipulis ovatis scariosis basi adnatis, petiolis apice spinosis vetustis paucis persistentibus, foliolis circiter 15-jugis obovatis rigidulis conspicue mucronatis, floribus in spicas densas longe pedunculatas aggregatis, bracteis parvis ovatis dense pilosis, calyce breviter piloso pilis albis nigrisque intermixtis, tubo magno post anthesin vesicario, dentibus parvis ovatis, petalis sulphureis breviter exsertis, ovario dense albo-sericeo uniloculari triovulato.

Herba perennis, subacaulis, radice duro elongato. *Folia* semipedalia, paripinnata, petiolo apice stramineo subpungente; foliola 3–4 lin. longa, mucrone stramineo pungente. *Pedunculi* stricti, erecti, adpresse albo-pilosi, 7–8 poll. longi. *Spicæ* 2–3 poll. longæ. *Calyx* pallidus vel purpurascens, tubo demum 5–6 lin. longo et lato. *Petala* 8–9 lin. longa, sulphurea, purpureo-venosa, vexillo glabro lamina orbiculari 2 lin. longa petalis reliquis vix longiore. *Fructum* maturum non vidi.

Ad *A. submitem*, Boiss. et Hohenack, magis accedit.

Badghis: 1049, May 19, 1885; Khorasan: August 19, 1885. Common in the low hills to 3000 feet altitude. The calyx becomes purple, making the plant very conspicuous.

ASTRAGALUS (§ CALYCOPHYSA) MERKIANUS, Aitch. et Baker, n. sp. Herbaceus, perennis, subacaulis, foliis pilis copiosis albis vestitis, stipulis lanceolatis basi adnatis, petiolis apice obscure spinosis vetustis pluribus persistentibus, foliolis circiter 20-jugis obovatis parvis conspicue mucronatis, floribus 10–12 in capitula longe pedunculata aggregatis, bracteis parvis ovatis dense pilosis, calyce dense breviter piloso pilis albis nigrisque copiosis intermixtis, tubo oblongo demum inflato scarioso, dentibus parvis deltoideis, petalis sulphureis breviter protrusis, ovario lineari dense albo-piloso uniloculari 2–3-ovulato.

Herba perennis, radice duro elongato, caule infra foliorum petiolis vetustis induratis ascendentibus prædito. *Folia* 4–6 poll. longa; foliola inferiora 4–5 lin. longa, superiora sensim minora. *Pedunculus* 6–7-pollicaris, strictus, erectus, dense breviter albo-pilosus. *Calyx* floriferus 6 lin. longus. *Petala* 8–9 lin. longa, vexillo glabro pallide sulphureo 3 lin. lato. *Fructum* non vidimus.

Ad *A. submitem*, Boiss. et Hohen., arcte accedit.

Badghis: 351, May 1, 1885.

ASTRAGALUS ANISACANTHUS, Boiss. Fl. Or. ii. p. 395.

Hari-rud valley: 1050, August 3, 4, 1885. A common, extremely spinous undershrub reaching two feet in height.

ASTRAGALUS HERATENSIS, Bunge; Boiss. Fl. Or. ii. p. 335. (Plate VI.)

Hari-rud valley: 1051, August 16, 1885. Native name *Gabina*. A common shrub, two to three feet in height; in habit very like a miniature oak, the main stem and lower branches being devoid of all spines and smooth, with a dark-coloured bark. From cracks in the bark exudes a gum called *Katira*; this is an article of commerce and export.

ASTRAGALUS, sp. aff. *A. strobilifero*, Royle; Hook. f. Flora British India, ii. p. 135.

Hari-rud valley: 571, May 26, 1885. Native name *Kon*, *Khon*.

Common along the base of the Paropamisus at an altitude of nearly 3000 feet. An undershrub from two to three feet in height. From this also exubes a gum called

Katira, which is considered one and the same thing as that yielded by *A. heratensis*, and with it is collected for exportation.

ASTRAGALUS (§ CERCIDOTHRIX) DURANDIANUS, Aitch. et Baker, n. sp. Herbaceus, perennis, multiceps, acaulis, foliis imparipinnatis pilis albis rigidulis dense vestitis, stipulis ovatis basi ad petiolum adnatis, petiolo brevi, foliolis 7 oblanceolato-oblongis parvis crassis, floribus solitariis breviter pedunculatis, calyce breviter piloso pilis albis paucis nigris multis, tubo oblongo post anthesin rupto, dentibus parvis lanceolatis, petalis pallidis glabris calyce sesquilongioribus, legumine sessili ovoideo albovilloso inflato biloculari, seminibus in loculo pluribus.

Herba perennis, dense cæspitosa. *Petioli* 3–4 lin. longi; lamina 5–6 lin.; foliola 2–3 lin. *Pedunculus* foliis brevior. *Calyx* semipollicaris segmentis tubo 4-plo brevioribus. *Petala* 8–9 lin. longa. *Fructus* imperfecte maturus 6–7 lin. longus, 4 lin. diam.

Ad *A. ammodytem*, Pall., et *A. Helmii*, Fisch., habitu magis accedit.

Khorasan: 688, June 18, 1885. This forms a close turf, on the pass to the south of Bezd, at an altitude above 6000 feet. It has extremely large pods for so small a plant, and they are covered with long silky grey hairs.

ASTRAGALUS (§ CERCIDOTHRIX) WEIRIANUS, Aitch. et Baker, n. sp. Perennis, caulibus brevibus erectis ramosis, stipulis lanceolatis dimidio inferiore ad petiolum adnatis, foliis imparipinnatis foliolis 3–5 oblanceolato-oblongis acutis pilis paucis albis hispidulis mediofixis præditis, racemis pedunculatis laxis multifloris, pedicellis brevibus, bracteis parvis ovato-lanceolatis, calyce parvo dense piloso pilis nigris et albis intermixtis tubo oblongo segmentis linearibus tubo duplo brevioribus, petalis violaceis calycem duplo superantibus, ovario cylindrico elongato recurvato glabro biloculari multiovulato.

Herba perennis, copiose ramosa, caulibus erectis pedalibus vel semipedalibus. *Folia* 12–18 lin. longa, foliolis pallide viridibus 9–12 lin. longis, 3–4 lin. latis. *Pedunculi* 1½–2 poll. longi. *Racemi* 2–2½ poll. longi. *Calyx* 3 lin. longus; vexillum glabrum, 6 lin. longum, petala reliqua distincte superans. *Fructus* immaturus calyce haud rupto triplo longior.

Badghis: 336, April 29, 1885. A woody undershrub about eighteen inches high, extremely common in sandy loam in the Badghis, where it forms good pasturage for goats and sheep. Flowers purplish.

ASTRAGALUS (§ CERCIDOTHRIX) HOLDICHIANUS, Aitch. et Baker, n. sp. Perennis acaulis, petiolis inermibus paucis vetustis persistentibus, foliis pilis albis rigidulis adpressis dense vestitis, stipulis ovatis acuminatis basi ad petiolum adnatis, foliolis 13–15 oblongis acutis vel obtusis, pedunculis elongatis, racemis laxis paucifloris, pedicellis brevibus, bracteis lanceolatis persistentibus, calyce pilis plerisque nigris brevibus adpressis vestito, tubo oblongo dentibus lanceolatis tubo duplo brevioribus, petalis luteis calyce sesquilongioribus, legumine lineari compresso recurvato elongato piloso polyspermo perfecte biloculari.

Herba perennis acaulis, radice duro elongato. *Petioli* 1–2 poll. longi; lamina 3–4 poll.; foliola breviter petiolulata, 4–6 lin. longa. *Pedunculus* 4–6 poll. *Racemi* 3–9-flori, 2–4 poll. longi, pedicellis floriferis ascendentibus 1½–2 lin. longis. *Calyx* semipollicaris. *Corolla* 9 lin. longa, vexillo glabro petalis reliquis paulo longiore. *Fructus* 15–18 lin. longus, 2½ lin. diam., breviter pilosus, crebre nigro maculatus.

Ad *A. incurvum*, Desf., et *A. incanum*, Linn., magis accedit.

Badghis: 347, April 29, 1885; May 19, 1885.

A very common plant in sandy loam, in which it sends down a long tough root, which, as well as that of several other species, is employed instead of rope or twine by the shepherds.

ASTRAGALUS SUBULATUS, Bieber.; Boiss. Fl. Or. ii. p. 481; Pallas, Ic. Astrag. t. 20.

Hari-rud valley: 201, April 10, 13, 18, 1885; May 9, 1885.

In sandy soil; most common.

ASTRAGALUS HYRCANUS, Pall.; Boiss. Fl. Or. ii. p. 488.

Hari-rud valley: 287, April 18, 21, 1885; Northern Baluchistan: October 3, 1884.

Native name in Baluchistan *Udish*.

A common shrub in the arid tracts, conspicuous from the extreme whiteness of its bark, and the rhachis of the very distant leaves persisting as spines. It is a valuable fodder-shrub in the desert, and the long leafless pliant branches were greedily eaten even by our horses. In the desert when the plant was perfectly bare of leaves its pyramidal form was quite characteristic and very striking.

ASTRAGALUS OLIGOPHYLLUS, Boiss. Fl. Or. ii. p. 488.

Hari-rud valley: 1052, May 9, 1885; Badghis: May 19, 1885.

ASTRAGALUS ANGUSTIFOLIUS, Lam.; Boiss. Fl. Or. ii. p. 489.

Khorasan: 666, June 17, 1885. Common, forming great flat hummocks, at an altitude of 5000 feet. One of the very characteristic plants of the country.

ASTRAGALUS (§ CERCIDOTHRIX) GOREANUS, Aitch. et Baker, n. sp. Fruticulosus, caulibus brevibus pilis albis adpressis dense vestitis, petiolis vetustis subspinosis pluribus persistentibus, stipulis lanceolatis basi ad petiolum adnatis, foliolis 9–15 oblanceolatis utrinque pilis albis hispidulis adpressis vestitis, racemis paucifloris breviter pedunculatis, pedicellis brevibus, bracteis parvis pilosis, calyce pilis nigris et albis dense vestito, tubo oblongo, dentibus lanceolatis tubo quadruplo brevioribus, petalis luteis calyce sesquilongioribus, legumine lineari recto sessili piloso polyspermo perfecte biloculari.

Fruticulus parvus dense ramosus, caulibus brevibus, foliorum rachidibus strictis subpungentibus erecto-patentibus. *Petioli* 6–12 lin.; lamina 2–3 poll.; foliola 3–6 lin. longa. *Racemi* 4–8-flori, pedicellis floriferis ascendentibus. *Calyx* 6–8 lin.

longus. *Petala* 9–10 lin. longa, vexillo glabro petala reliqua superante. *Fructus* 15–16 lin. longus, 2½ lin. diam.

Ad *A. hyrcanum*, Pall., magis accedit.

Hari-rud valley: 1053, May 9, 1885. A low shrub, about 2 feet in height.

ASTRAGALUS (§ CERCIDOTHRIX) TALBOTIANUS, Aitch. et Baker, n. sp. Fruticulosus, caulibus brevibus, petiolis vetustis strictis pluribus persistentibus, foliis imparipinnatis pilis albidis hispidulis adpressis ubique vestitis, stipulis lanceolatis basi ad petiolum adnatis, foliolis 9–13 oblanceolatis subacutis, racemis paucifloris breviter pedunculatis, pedicellis brevibus nigro-pilosis, bracteis parvis lanceolatis, calyce pilis plerisque nigris dense vestito, tubo oblongo-cylindrico, dentibus lanceolatis tubo 3–4-plo brevioribus, petalis luteis calyce sesquilongioribus, ovario lineari biloculari multiovulato.

Habitus omnino *A. Goreani*. *Petioli* 6–15 lin. longi; lamina 1–2½ poll.; foliola 3–6 lin. longa. *Pedunculus* 1–2 poll. longus. *Racemi* 2–6-flori, pedicellis floriferis 1–2 lin. longis omnibus ascendentibus. *Calyx* 8–9 lin. longus. *Corolla* circiter pollicaris, vexillo glabro petala reliqua superante.

Ad præcedentem (*A. Goreanum*) arcte accedit. Varietas *condensatus* adest, habitu dense condensato, floribus et foliis minoribus.

Hari-rud valley: 202, April 13, 1885 (type); April 10, 1885 (var. *condensatus*).

A common small bush much browsed by sheep, &c.

GLYCYRRHIZA GLABRA, Linn.; Boiss. Fl. Or. ii. p. 202.

Hari-rud valley: August 5, 1885; Badghis: 129, March 1885, May 22, 1885.

Native name *Mahk, Sus.* One of the most common and characteristic shrubs of the Badghis, and generally common throughout the Hari-rud valley, but always near water. I do not remember ever seeing it in Khorasan. The great underground root-stocks make excellent fuel even when green and moist; and from them is obtained a common household medicine, a coarse extract (Liquorice), called by the Turkomans *Mahk*, and by the Persians *Asus, Rob-a-sus.*

GLYCYRRHIZA GLABRA, Linn. var. γ. GLANDULIFERA, Reg. et Herd.; Boiss. Fl. Or. ii. p. 202.

Badghis: 509, May 18, 1885; Hari-rud valley: June 6, 1885.

GLYCYRRHIZA TRIPHYLLA, Fisch. et Mey.; Boiss. Fl. Or. ii. p. 203.

Hari-rud valley: 737, August 8, 1885; Khorasan: July 3, 1885.

Among stony shingle, forming a thick sward in the beds of dried-up water-courses, especially on the tract of land between two stream-beds where they join. Flowers extremely pretty, in snow-white spikes.

EVERSMANNIA HEDYSAROIDES, Bunge; Boiss. Fl. Or. ii. p. 510.

Hari-rud valley: 574, May 27, 1885.

Common in gravel and clay soil, on the sides of escarpments, a bush of from two to three feet covered with dense masses of rose-coloured flowers; very handsome and would be well worth cultivating.

NOTE.—Dr. Regel identifies this with *Eversmannia astragaloides*, Reg. et Schmalh. (in Reg. Pl. Nov. Fedtsch. p. 18), which, with a large number of specimens before us, we should regard, as he himself suggests in the place cited, as a state of *E. hedysaroides*.

HEDYSARUM MAITLANDIANUM, Aitch. et Baker, n. sp. Perenne, caule producto pilis albis brevibus tenuiter vestito, stipulis deltoideis membranaceis, foliolis 5–7 obovatis obtusis utrinque breviter albo-pilosis, racemis laxis paucifloris longe pedunculatis, pedicellis brevibus dense pilosis, bracteis bracteolisque lanceolatis, calyce dense piloso dentibus lanceolatis tubo duplo longioribus, petalis saturate lilacinis calyce duplo longioribus, vexillo glabro carina sublongiore, legumine recurvato pedicellato articulis 3–4 suborbicularibus discoideis facie glabris venulosis margine breviter ciliatis.

Herba erecta semipedalis vel pedalis. *Petioli* 6–12 lin. longi; lamina 2–3 poll.; foliola 6–9 lin. longa. *Pedunculi* stricti, 2–4 poll. longi. *Racemus* demum 2–3-pollicaris. *Calyx* 3 lin. longus, vexillum 8–9 lin. longum, 5–6 lin. latum. *Leguminis* articuli 2–3 lin. longi.

Ad stirpem *Multicaulia*, Boiss., prope *H. elymaiticum*, Boiss. et Haussk., pertinet.

Badghis: 381, May 2, 4, 1885; Hari-rud valley: May 19, 1885.

A dense bush, about a foot in height, with very numerous annual shoots, growing closely together and forming clumps of from nine to twelve feet in circumference. Flowers large, rose-pink, in loose spikes. A very handsome shrub when in full flower. Common.

HEDYSARUM WRIGHTIANUM, Aitch. et Baker, n. sp. Perenne, caulibus brevibus dense albo-incanis, stipulis e basi deltoidea acuminatis, foliolis 13–15 lineari-oblongis obtusis facie subcalvatis dorso albo-pilosis, racemis pedunculatis elongatis multifloris, pedicellis brevibus dense pilosis, bracteis minutis deciduis, calyce dense piloso dentibus linearibus tubo campanulato 3–4-plo longioribus, floribus parvis sordide rubello-luteis, vexillo alisque calyci æquilongis carina brevioribus, legumine piloso pedicellato articulis 1–3 facie et margine longe crinitis.

Caules dense cæspitosi, semipedales vel pedales. *Petioli* 6–12 lin. longi; lamina 2–4-pollicaris; foliola 9–12 lin. longa, 1½–2 lin. lata. *Racemus* demum 3–4 poll. *Calyx* 3 lin. longus. *Carina* 4–5 lin. *Leguminis* articuli demum 3 lin. longi, setis 1½–2 lin. longis brunneis vel purpurascentibus.

Ad *H. criniferum*, Boiss., et *H. micropterum*, Bunge, magis accedit.

Hari-rud valley: 421, May 10, 28, 1885; Badghis: April 4, May 19, 1885.

An extremely common shrub, greedily eaten by goats and sheep. The ripe fruit is covered with bright purple bristles.

ONOBRYCHIS MICRANTHA, Schrenk; Ledebour, Fl. Ross. i. p. 710.

Hari-rud valley: 405, May 9, 1885; 611, June 6, 1885.

An excessively common annual, in stony soil. The form of the fruit might give artists a new design for ear-rings.

Onobrychis tavernieræfolia, Stocks; Boiss. Fl. Or. ii. p. 545.

Hari-rud valley: 320, April 26, 1885; May 9, 1885.

An annual, common in sand; the whole plant is spread out flat, and grows close to the soil. The fruit escapes observation until the plant is removed from the ground, and the lower side turned up.

Onobrychis cornuta, Desv.; Boiss. Fl. Or. ii. p. 537.

Khorasan: 686, June 18, 1885.

Common above 5000 feet altitude, forming immense hummocks, very characteristic of the country.

Onobrychis (§ Hymenobrychis) megalobotrys, Aitch. et Baker, n. sp. Perennis, caulibus elongatis erectis molliter albo-pilosis, stipulis liberis lanceolatis, foliolis 15–17 oblongis mucronatis facie glabris dorso pilosis, racemis laxis longissimis, pedicellis brevibus pilosis, bracteis parvis lanceolatis membranaceis, calyce piloso, dentibus e basi lata acuminatis tubo campanulato longioribus, vexillo sericeo rubello-luteo calyce triplo longiore, alis obtusis auriculatis calyce brevioribus, legumine orbiculari piloso late cristato margine spinuloso disco profunde foveolato parce spinoso.

Caulis pedalis et ultra. *Petiolus* 1–2-pollicaris; lamina 4–5 poll.; foliola inferiora 1 poll. longa. *Racemus* demum pedalis. *Calyx* 2 lin. longus. *Vexillum* 6 lin. longum. *Fructus* 6 lin. longus, sutura seminifera curvata.

Ad *O. Pallasii*, Bieb., et *O. hyperargyræam*, Boiss., magis accedit.

Badghis: 340, April 29, 1885; May 21, 1885.

A perennial, from two to three feet in height, with spikes of purple-veined flowers almost a foot in length; growing in great luxuriance in the sandy loamy soil of the Badghis, and especially around Gulran.

Onobrychis (§ Hymenobrychis) caloptera, Aitch. et Baker, n. sp. Annua, caulibus elongatis erectis gracilibus glabris, stipulis ovatis acuminatis membranaceis liberis, foliolis 9–11 lanceolatis mucronatis maturis facie glabris dorso tenuiter adpresse albo-pilosis, racemis multifloris laxifloris, pedicellis calyci æquilongis, bracteis minutis lanceolatis membranaceis, calyce piloso dentibus lanceolatis acuminatis tubo campanulato 2–3-plo longioribus, petalis parvis rubellis, vexillo oblongo glabro calyce duplo longiore, alis calyci subæquilongis, legumine glabro late cristato, crista hyalina chartacea integra basi producta, disco profunde foveolato haud spinoso.

Caulis subpedalis. *Petiolus* 6–12 lin. longus; lamina demum 3–4 poll.; foliola 12–15 lin. longa, 2–3 lin. lata. *Racemi* floriferi 1–1½ poll.; fructiferi 2–3 poll. longi. *Calyx* 1½ lin. longus. *Fructus* 6–7 lin. longus, crista 1 lin. lata.

Badghis: 393, May 4, 14, 1885.

A tall annual, common over the Gulran meadows.

Onobrychis Aucheri, Boiss., Fl. Or. ii. p. 544, ex descriptione.

Hari-rud valley: 452, May 12, 1885; June 6, 1885.

In sandy soil, common. In its habit of growing closely appressed to the ground it resembles *O. tavernieræfolia.*

Alhagi camelorum, Fisch.; Boiss. Fl. Or. ii. p. 559.

Northern Baluchistan: 33, Oct. 3, 1884. Khorasan: 703, June 29, 1885; August 23, 1885. Native names: *Khar-i-buz, Shuthar-khar.*

A very common shrub, from three to four feet in height, on open plains in gravelly soil, frequently growing gregariously. A very valuable fodder for camels and which in certain localities, depending much on the season, yields a manna called *Tar-anjabin*, which is collected for local use, as well as for exportation.

Cicer arietinum, Linn.; Boiss. Fl. Or. ii. p. 560.

Khorasan: 714, July 19, 1885.

Native name *Nakhud.* Cultivated under irrigation at an altitude of 5000 feet.

Vicia Ervilia, Willd.; Boiss. Fl. Or. ii. p. 595, syn. *Ervum Ervilia*, Linn.

Khorasan: 670, June 17, 1885.

Native name *Adas.* Cultivated at an altitude above 4000 feet.

Vicia hyrcanica, Fisch. et Mey.; Boiss. Fl. Or. ii. p. 571.

Badghis: 485, May 17, 1885; Hari-rud valley: June 5, 1885.

Common in the Badghis; and only in the Hari-rud valley in cultivated soil, margins of fields, &c.

Vicia peregrina, Linn.; Boiss. Fl. Or. ii. p. 576, var. pedicellis longioribus floribus minoribus.

Badghis: 385, May 3, 1885; 518, May 9, 1885; 521, May 20, 1885.

Common. Differs from the type in the pedicels being often longer than the calyx, and in having smaller flowers.

Vicia villosa, Roth; Boiss. Fl. Or. ii. p. 591.

Hari-rud valley: 441, May 11, 1885.

In hedges near cultivation, very common. In habit resembling *Vicia Cracca.*

Lens esculenta, Mœnch.—*Ervum Lens*, Linn.; Boiss. Fl. Or. ii. p. 598.

Khorasan: 664, June 17, 1885.

Native names: *Adah, Adas.* Cultivated in fields above 5000 feet altitude.

Lathyrus subvillosus, Aitch. et Hemsl.—*Orobus subvillosus*, Ledeb. Fl. Alt. iii. p. 359.

Badghis: 348, May 1, 19, 1885.

Common, in the low hills, at 3000 feet elevation; a dwarf everlasting pea, with handsome heads of large purple flowers, growing in great luxuriance. Would be well worth cultivating.

Lathyrus Aphaca, Linn.; Boiss. Fl. Or. ii. p. 602.

Hari-rud valley: 445, May 11, 1885. Very common in cultivated soil.

Ammothamnus Lehmanni, Bunge; Boiss. Fl. Or. ii. p. 628.

Hari-rud valley: 327, April 27, 1885; May 28, 1885; June 4, 1885.

A common shrub, with a large root-stock, from which numerous annual flowering stems spring, bearing loose spikes of flowers from six to nine inches in length and pure white in colour. The plant when in flower is very handsome.

Sophora pachycarpa, C. A. Mey.—*Goebelia pachycarpa*, Boiss. Fl. Or. ii. p. 629.

Hari-rud valley: 435, May 10, 1885; June 3, 4, 1885; July 27, 1885.

Native name *Talkh-ak.*

Equally common with *Ammothamnus*, and scarcely to be distinguished from it when in leaf only. This blossoms later, and has the white flowers clustered. It is very bitter, hence the native name.

Sophora mollis, Graham in Wall. Cat.; Hook. f. Flora British India, ii. p. 251.

Khorasan: 801, August 23, 1885. A shrub from four to five feet high; only once collected and then neither in flower nor fruit.

Sophora Griffithii, Stocks.—*Keyserlingia Griffithii,* Boiss. Fl. Or. ii. p. 630.

Northern Baluchistan: 3, September 25, 1884.

Cercis Siliquastrum, Linn.; Boiss. Fl. Or. ii. p. 633.

Mount Do-shakh: 765, August 4, 5, 1885. Native names: *Arghamon, Argahwan.*

A tree, or tall shrub, common in the stream-beds leading north from Mt. Do-shakh. The shoots, which are a deep purple or almost black in colour, are employed largely in the manufacture of baskets, sieves, and strainers, especially in Persia, where the plant is also very common. The tree at Baber's tomb, near Cabul, is this. It is a common shrub or tree, perfectly indigenous, and was not introduced, as some supposed, into that locality.

Prosopis Stephaniana, Spreng.; Boiss. Fl. Or. ii. p. 633.

Hari-rud valley: 1054, May 25, 1885; August 6, 19, 1885. Khorasan: August 23, 28, 1885. Native names: *Chiggak, Chogak, Khar-i-jinghak.*

A common shrub from the Helmand northwards. Over the whole Badghis from Bala Morghab to the Hari-rud valley and Persia. The pods are usually infested by insects, and become immensely enlarged and irregular in form. They are called *He-chi,* and are employed in tanning, for which purpose they are collected and exported.

ROSACEÆ.

Prunus divaricata, Ledeb.; Boiss. Fl. Or. ii. p. 651.

Hari-rud valley: 253, April 16, 1885. Native name of the tree and its fruit *Alubokhara.*

A small tree, cultivated in orchards; usually self-sown, and not from grafts. The fruit is a small plum.

Prunus prostrata, Labill.—*Cerasus Griffithii,* Boiss. Fl. Or. ii. p. 648.

Badghis: 551, 554, May 23, 24, 25, 1885. A small tree or shrub, on the Paropamisus range, at an altitude above 3500 feet; common.

Our specimens correspond exactly with those of *Cerasus Griffithii*, Boiss.; and this we consider to be a form of *Prunus prostrata*, Labill.

PRUNUS PROSTRATA, Labill.; Boiss. Fl. Or. ii. p. 648, var.?

Paropamisus range: May 25, 1885; Khorasan: 1055, June 16, 1885.

Near water, at an altitude above 3500 feet. By an oversight no specimen of this was retained for the Kew Herbarium.

PRUNUS (§ CERASUS), sp.

Hari-rud valley: 257, April 15, 1885. Native name *Gurjha*, the fruit *Alu-balu*.

A small tree, cultivated in orchards for its fruit, which is rather larger than an ordinary cherry, almost black in colour, and very austere and harsh to a European palate.

PRUNUS (§ CERASUS) CALYCOSUS, Aitch. et Hemsl. n. sp. (Plate VIII.) *Frutex* 8–10-pedalis, undique fere glaber, dense ramosus. *Folia* parva ad apices ramorum lateralium brevium conferta, graciliter petiolata, papyracea vel fere membranacea, ovato-oblonga, absque petiolo 6–12 lineas longa, apice sæpius rotundata, basi cuneata, argute serrulata; petiolus 2–4 lineas longus; stipulæ membranaceæ, lineares, acutissimæ, 3–4 lineas longæ, dentatæ vel sublaceratæ. *Flores* rosei, sæpius bini, graciliter pedunculati, e gemmis lateralibus infra folia oriundi; pedunculus gracilis, 4–6 lineas longus; calycis tubus cylindricus, basi leviter ventricosus, 3–4 lineas longus; calycis segmenta petaloidea, venosa, tubo paullo longiora, obovato-oblonga, concava, subsinuata, intus basi villosa; petala nulla vel saltem non visa; stamina 8–10; ovarium glabrum, stylo staminibus æquali. *Fructus* maturus ignotus.

Badghis: 1059, May 1, 3, 1885. Native name *Siah-ling*, yields a fruit *Alucha*.

A shrub or small tree, with very dark-coloured cherry-like bark; common in the hills at an altitude above 3000 feet. The stems are valued as staves, and the bark of the root is employed as a dye-stuff, for producing a dark red or maroon colour. The fruit is said to be the size of a cherry.

PRUNUS TORTUOSA, Aitch. et Hemsl.—*Cerasus tortuosa*, Boiss. et Haussk.; Boiss. Fl. Or. ii. p. 647.

Badghis: 134, March 18, 31, 1885; April 1, 1885.

A common bush in the hills, above 3000 feet elevation. Flowers before the leaves.

It would be better perhaps to treat this as a variety of *Prunus microcarpa*, C. A. Mey., syn. *Cerasus orientalis*, Spach.

PRUNUS MICROCARPA, C. A. Mey.—*Cerasus microcarpa*, Boiss. Fl. Or. ii. p. 646.

Paropamisus range: 1058, May 25, 1885; Khorasan, June 16, 1885.

Common at an altitude above 3500 feet.

PRUNUS ARMENIACA, Linn.—*Armeniaca vulgaris*, Lam.; Boiss. Fl. Or. ii. p. 652.

Hari-rud valley: 259, April 16, 1885; 256, April 16, 1885. Native name *Zard-alu*.

The ordinary cultivated apricot, the kernels of which are bitter; it is raised from seed and layers. Common in orchards.

There is a variety with sweet kernels, which is grafted; it is merely spoken of as "the grafted," or as "the sweet-kernelled" one, and is much less common than the former, PRUNUS AMYGDALUS, Baill.—*Amygdalus communis*, Linn.; Boiss. Fl. Or. ii. p. 641.

Hari-rud valley: 243, April 16, 1885. Native name for tree and fruit *Bedam*; cultivated in orchards.

PRUNUS PERSICA, Benth. & Hook. f.—*Persica vulgaris*, Mill.; Boiss. Fl. Or. ii. p. 640.

Hari-rud valley: 250, April 16, 1885.

Native name *Shaft-alu.* Cultivated in orchards and always grafted; bears fine fruit.

PRUNUS EBURNEA, Aitch. & Hemsl.—*Amygdalus eburnea*, Spach.; Boiss. Fl. Or. ii. p. 645, var. floribus solitariis.

Hari-rud valley: 1056, April 15, 1885.

Varies from the type in having solitary flowers, and the calyx and leaves woolly.

Aol is the native name for *P. eburnea* and *P. brahuica*, both of which yield excellent fuel.

PRUNUS EBURNEA, Aitch. & Hemsl., var. fructu flavo.—*Amygdalus eburnea*, Spach.; Boiss. Fl. Or. ii. p. 645.

Badghis: 1057, May 22, 1885.

Noted on the spot that the fruit was ripening yellow, like an apricot; but this may have been due to an insect affecting it.

PRUNUS BRAHUICA, Aitch. & Hemsl., var. calyce omnino glabro.—*Amygdalus brahuica*, Boiss. Fl. Or. ii. p. 645.

Badghis: 133, March 18, 1885; May 20, 1885.

PRUNUS, sp. aff. *P. brahuicæ*, Aitch. & Hemsl.

Hari-rud valley: 1151, 1885. At an altitude of 3000 feet. Fruit only, which is broader than that of *P. brahuica.*

RUBUS DISCOLOR, Weihe et Nees; Boiss. Fl. Or. ii. p. 695.

Mount Do-shakh: 1060, August 5, 1885. Near running water, in shady places; very common above 3000 feet altitude. Extends throughout the Badghis from Bala-morghab westwards across the Hari-rud valley into Khorasan.

RUBUS CÆSIUS, Linn.; Boiss. Fl. Or. ii. p. 693.

Badghis: 537, May 22, 1885. Throughout the Badghis, near running water, in gravelly soil, common.

POTERIUM SANGUISORBA, Linn.; Boiss. Fl. Or. ii. p. 733.

Badghis: 528, May 21, 24, 1885. At an altitude of 3000 feet, common.

ROSA BERBERIFOLIA, Pall.—*Hulthemia berberifolia*, Dumort.; Boiss. Fl. Or. ii. p. 668.

Hari-rud valley: 305, April 22, 25, 1885; May 12, 1885; June 4, 1885. Badghis: April 29, 1885; May 19, 1885. The most characteristic shrub of the country from Bala-morghab westward, over the whole Badghis, the Hari-rud valley into Khorasan; up to an altitude of 5000 feet. Flowers bright yellow, with a dark purple spot at the base of each petal.

ROSA DAMASCENA, Mill.; Hook. f. Fl. British India, ii. p. 364.

Hari-rud valley: 254, April 16, May 12, 1885. Native name *Gulab.* Cultivated in gardens and orchards for the flowers, which are daily collected and made over to the distiller for the manufacture of rose-water. I never saw more than half a dozen bushes in any of the gardens.

ROSA LUTEA, Mill.; Boiss. Fl. Or. ii. p. 671.

Hari-rud valley: 245, April 16, May 12, 1885. Native name *Gul-i-ranan zeba*. Cultivated in orchards and gardens; the flower is yellow and single, and not briar-scented. It is the Persian yellow rose of our gardens.

ROSA MOSCHATA, Mill.; Hook. f. Fl. British India, ii. p. 367.

Hari-rud valley: 749, July 30, 1885. Cultivated in the vicinity of shrines in Afghanistan, and also in Persia.

ROSA ANSERINÆFOLIA, Boiss. Fl. Or. ii. p. 677.

Badghis: 504, May 18, 1885. Not common, on damp rocks near Sim-koh, at an altitude of 3200 feet. Briar-scented; flowers almost pure white.

ROSA BEGGERIANA, Schrenk; Crépin, Prim. Monogr. Ros. in Bull. Soc. Bot. Belg. xiv. 18 (reprint, p. 312), et var. γ. *Lehmanniana*, Crépin, *l. c.* p. 20.

Mount Do-shakh: 1061, August 5, 1885. Specimens marked "A," locality not recorded. Common at 4000 feet altitude near running streams and in shade. This is remarkable for the peduncles bearing the ripe fruit being fleshy and of the same colour as the fruit.

Var. γ. LEHMANNIANA.

Badghis: 352, May 1, 1885; Khorasan, 657, June 16, 1885. Common, on the sides of running streams, above 3000 feet altitude.

PYRUS CYDONIA, Linn.—*Cydonia vulgaris*, Pers.; Boiss. Fl. Or. ii. p. 656.

Hari-rud valley: 246, April 4, 1885. Native name *Bhihi*. The Quince is commonly cultivated in orchards. The fruit is usually very large and of fine quality from grafted trees.

PYRUS COMMUNIS, Linn.; Boiss. Fl. Or. ii. p. 653.

Hari-rud valley: 248, April 16, 1885. The Pear; native name *Amrud*. Cultivated in orchards; this form bears a small pear called *Amrud*; it is raised by slips or seed, but is not grafted. There is also a variety raised always by grafting on this, which bears a large fruit, for which the native name is *Nak*. This is the fruit that is so largely exported from other parts of Afghanistan into India. In the Badghis I came upon a small forest of Pear-trees which I thought might have been the remains of an old orchard, but I was informed that this was not the case. The tree is well known as a wild one. It is called *Amrucha* from the small fruit it bears, this being a diminutive for *Amrud*. The fruit is dried, ground into a flour, and mixed with ordinary wheat flour to increase its bulk.

PYRUS MALUS, Linn.—*Malus communis*, Desf.; Boiss. Fl. Or. ii. p. 656.

Hari-rud valley; 258, April 16, 1885. The Apple; native name *Seb*. A cultivated tree in orchards, said not to be grafted. In the hills around Kushk and above Bala-morghab a wild apple is reported to be common, and the fruit a little smaller than the cultivated one, yet good to eat.

Cratægus Oxyacantha, Linn., var.; Boiss. Fl. Or. ii. p. 664.

Badghis: 349, May 1, 25, 1885. Native names: *Daluna, Alaf-karez, Alaf-khez, Guj-i-kohja, Seb-ak.* Plentiful as a small tree, above 3000 feet elevation, usually in the vicinity of streams.

Cotoneaster nummularia, Fisch. & Mey.; Boiss. Fl. Or. ii. p. 666; Aitchison, Pharmac. Journ. & Trans. 3rd ser. xvii. p. 467, Lond. 1887. (Plate IX.)

Paropamisus range: 396, May 5, 1886; May 24, 1885; June 16, 1885. Native name *Siah-chob.* A tall shrub or small tree; common on all the hills where there is moisture, at 4000 feet altitude. The stems are esteemed for walking-sticks, and for handles to agricultural implements, axes, &c. From this shrub a manna called *Shir khist* at a certain season of the year is collected; it is largely exported to Hindostan and Persia.

LYTHRARIEÆ.

Lythrum Hyssopifolia, Linn.; Boiss. Fl. Or. ii. p. 739.

Khorasan: 783, August 19, 1885. In clay soil, on the sides of irrigation-channels and streams; not common.

ONAGRARIEÆ.

Epilobium hirsutum, Linn.; Boiss. Fl. Or. ii. p. 746.

Hari-rud valley: 768, August 5, 1885; Khorasan, June 29, 1885. Common in all irrigation-channels.

CUCURBITACEÆ.

itrullus Colocynthis, Schrad.; Boiss. Fl. Or. ii. p. 759.

Northern Baluchistan: 16, Sept. 29, 1884. Native name *Kur-kushta.* Very common all over the desert country.

Citrullus vulgaris, Schrad.; Boiss. Fl. Or. ii. p. 759, obs.; Hook. f. Fl. British India, iii. p. 621.

Native name for the Water-melon *Hindu-ani.* Cultivated extensively over the whole country traversed from Northern Baluchistan to Bala-morghab, and west to Khorasan. During autumn, when travellers are moving in localities where they are uncertain of obtaining water, or there is a probability of its being saline, a donkey-load or so of water-melons is always conveyed along with the party, supplying both food and drink. The fruit, as a rule, is very much sweeter than any I ever tasted in India.

Cucumis trigonus, Roxb.; Boiss. Fl. Or. ii. p. 758.

Helmand: Oct. 25, 1884. What I, from memory, believe to have been the above species was extremely common in clayey soil, near cultivation, that had been flooded with water, between Kalifat and Padda-sultan. Our camp-followers feasted on the small ripe fruit, both in its natural condition and cooked.

CUCUMIS MELO, Linn.; Boiss. Fl. Or. ii. p. 759, Obs. sub *C. trigonus*; Roxb. Fl. British India, iii. p. 620.

Native name for the Melon, *Khar-buze.* Cultivated, though not to the great extent that the water-melon is. The variety of the fruit distinguished as the *Sarda* is certainly very fine, and it is this that is so largely exported to India during the winter months.

BRYONIA MONOICA, Aitch. et Hemsl., n. sp. (Plate X.) *Herba* alte scandens, caulibus annuis gracilibus lævibus. *Cirrhi* simplices. *Folia* graciliter petiolata, ambitu cordato-ovata, inæqualiter 5-lobata, lobo terminali longiore acuto, supra lævia, subtus scabrida, cum petiolo 2½–4 poll. longa. *Flores* viridi-lutei, papillosi, feminei et masculini in eodem racemo, 1 vel plures inferiores feminei, racemis foliis demum æquilongis vel longioribus; calyx fl. fem. in tubo supra ovarium productus, segmenta linearia, inæqualia, petalis æqualia vel longiora; petala ovato-oblonga, vix acuta; stamina 3, fere sessilia; antheræ magnæ, una unilocularis, ceteræ biloculares; stylus elongatus, stigmate trilobato leviter papilloso. *Fructus* maturus non visus.

Badghis: 339, April 29, 1885. Very common in the beds of dry water-courses, at an altitude of about 2500 to 3000 feet; climbing upon and completely covering with its dense foliage large shrubby species of *Tamarix.* The fruit ripens red.

This species differs from *Bryonia alba*, the only other monœcious species described, in the male and female flowers being borne in the same racemes, and in having long narrow calyx-lobes.

UMBELLIFERÆ.

ERYNGIUM CARLINOIDES, Boiss.; Fl. Or. ii. p. 825.

Hari-rud valley: 754, August 1, 1885. In great luxuriance, everywhere on the clayey and gravelly plains; from one to two feet in height, sometimes very bushy.

ECHINOPHORA PLATYLOBA, DC.; Boiss. Fl. Or. ii. p. 749.

Korasan: 819, September 3, 1885. A low shrub with lemon-scented flowers, yielding a red gummy exudation. Common in stony places.

PYCNOCYCLA AUCHERIANA, Decaisne; Boiss. Fl. Or. ii. p. 949.

Northern Baluchistan: 18, September 1884, October 10, 1884; Khorasan: 817, September 2, 1885. In the gravelly beds of dry water-courses, very common, especially in the desert country. The root-stocks, when employed for fuel, exhale a fœtid odour.

CONIUM MACULATUM, Linn.; Boiss. Fl. Or. ii. p. 922.

Badghis: 539, May 22, 1885; Khorasan: June 16, 1885. In moist localities near water, in the shade of shrubs and trees; growing as much as seven feet in height. Common at an altitude above 5000 feet.

TRACHYDIUM LEHMANNI, Benth. & Hook. f.—*Eremodaucus Lehmanni*, Bunge; *Albertia margaritifera*, Regel & Schmalh.; Boiss. Fl. Or. ii. p. 930. (Plate XI.)

Badghis: 471, May 16, 21, 1885. Native name *Shahk-akhal.* A very common annual in the loamy soil of the Badghis. The central flower of the umbel usually exhibits a rose-coloured exudation, caused by the puncture of an insect. The roots are collected and exported to India, *viâ* Herat.

TRACHYDIUM KOTSCHYI, Boiss. Fl. Or. ii. p. 929.

Hari-rud valley: 417, May 10, 1885, June 18, 1885; 560, Paropamisus range: May 25, 1885. General throughout the country in the low hills.

SMYRNIUM CORDIFOLIUM, Boiss. Fl. Or. ii. p. 926.

Paropamisus range: 399, May 5, 1885. Native name *Kun-halk*. In damp localities, near water; at an altitude above 3000 feet. The natives eat it both raw and cooked.

APIUM GRAVEOLENS, Linn.; var. Boiss. Fl. Or. ii. p. 856.

Badghis: 106, December 8, 1884. A very common plant, on the steep banks of slow-running streams.

CARUM BULBOCASTANUM, W. D. J. Koch; Hook. f. Fl. British India, ii. p. 681.

Hari-rud valley: 312, April 25, 26, 1885. Common in cultivated land. The bulbs, *Jiri-shak*, collected by the natives and eaten raw. Wild pigs are very destructive in fields, apparently on the search for these roots.

CARUM (§ EUCARUM), sp.

Hari-rud valley: 368, May 1, 1885. Common in soft soil; roots tuberous, as in the last.

CARUM (§ EUCARUM), sp.

Badghis: 524, May 20, 1885. Profuse on sides of running streams.

CARUM (§ PTYCHOTIS) LEPTOCLADUM, Aitch. et Hemsl., n. sp. (Plate XXII.) *Herba* annua, gracillima, glaberrima, divaricatim ramosa, 4–8 poll. alta. *Folia* biternatim partita, ternatim partita vel superiora simplicia, segmentis linearibus acutis 6–9 lineas longis. *Umbellæ* 4–6-radiatæ, pedunculis divergentibus filiformibus; umbellulæ 8–12-floræ, bracteis bracteolisque parvis scariosis. *Flores* albi; petala majuscula, valde inflexa; stylopodium crassiusculum, basi non dilatatum; styli recurvi, stigmatibus capitatis. *Fructus* latior quam longus, a latere breviter compressus, tota pilis crassiusculis albidis capitatis vestitus; vittæ ad valleculas solitariæ, inconspicuæ, commissura bivittata; carpophorum bifidum.

Hari-rud valley: 603, June 5, 1885. Very common in gravelly soil. A small annual, usually from 3 to 4 inches in height, sometimes as much as 8 inches, with very elegant fine wire-like stems; flowers minute, white.

PIMPINELLA, sp.

Hari-rud valley: 1062, 1885. Quite young and indeterminable.

SCANDIX PINNATIFIDA, Vent.; Boiss. Fl. Or. ii. p. 916.

Badghis: 489, May 17, 1885. In the shade of rocks and between boulders; common.

PRANGOS PABULARIA, Lindl.; Hook. f. Fl. British India, ii. p. 695.

Badghis: 386, May 3; 492, May 17, 1885; Paropamisus range, May 25, 1885.

Native name *Badian-kohi*. On the shady sides of rocks, from 3000 feet elevation at Simkho, to 6000 feet on the Paropamisus range; not uncommon.

FERULA OOPODA, Boiss. Fl. Or. ii. p. 984. (Plates XVIII., XIX.) (Descript. amplif.) *Caulis* 4–6-pedalis, erectus, albescens vel rubescens, subnitidus. *Folia* impetiolata, radicalia 3–4 ped. diametro, iterato-tripartita, late vaginata; caulina sursum gradatim minora, cum vaginis amplexicaulibus cyathiformibus gradatim minoribus instructis. *Inflorescentia* ampla, terminalis, subverticillatim ramosa. *Flores* polygami, umbellæ centralis fertiles, umbellarum minorum lateralium centralem superantium sæpissime masculi. *Fructus* oblongus, valde dorso compressus, fere planus; vittæ ad valleculas solitariæ, ad commisuram geminatæ.—*Peucedanum oopodum*, Boiss. et Buhse, Aufz. p. 100.

Badghis: 114, February 18, 1885; Hari-rud valley: 321, April 26, 1885, May 13, 1885; Khorasan, June 9, 1885. Native native *Ejik-okharasi*, *Kilki*, *Kalkilli*. Generally distributed throughout the Badghis, and the most northern part of the Hari-rud valley; occasional in Khorasan, growing gregariously. Its annual stems reach six feet in height, and are remarkable for the three large cups, or bowls, borne on the stem. Were it cultivated in this country, at which an attempt has been made, these bowls, with the upper part of the stalk cut off close to the base of the cup, and of the lower portion four inches left as a handle, they would make lovely artistic bouquet- or fruit-holders. The Turkomans have a story that on some occasion when a fugitive fleeing from his enemies was dying from thirst, he got a life-saving drink of water out of one of these cups, from the dew collected therein. I examined many, but not a drop of fluid could I ever find in any of them; their usual occupants being beetles and a small bee.

It was only after a very careful examination of the fragmentary specimens of *Ferula oopoda*, Boiss., in the Kew Herbarium, and Boissier's imperfect description, that we thought it probable ours could be the same. Boissier had neither radical leaves nor fruit, and apparently only very much less luxuriant specimens; for he says of the leaf-sheaths:—"Vaginæ caulinæ interdum ovo gallinaceo vix minores." In the present specimens the larger of these sheaths are at least six inches across, and the largest observed lower on the stem, were at least a foot across; and they more nearly resemble a bowl or cup than an egg. Nevertheless, from the specimens before us, we have little doubt that we are right. Certainly a portion of Stocks's Baluchistan 956, which is referred by Boissier to *F. oopoda*, is the same species. This is also very near to *Ferula Schaïr*, Borszczow (Ferul. Aral. Casp. p. 37, tt. 6–8), but that is represented as having open, not connate, sheaths, and narrower ultimate segments of the leaves. In this connexion it may be mentioned that Stocks writes the native name of *F. oopoda*, and of another very distinct species which he confused with it, "Cheer." We are a little puzzled with Borszczow's description of *F. Schaïr*, as we have not found the same conditions that he describes in any of the species which we have examined. The central umbels he describes as consisting of fertile female flowers, the lateral, smaller umbels which rise above the central, of sterile females, and the clusters of minute flowers seated near the base of the peduncles of the lateral umbels, males. He says of *Ferula Schaïr*:—

"*A Fer. soongorica,* Pall., *quæ mihi ex descriptione tantum optime notis cursive impressis differt*;" and these are the words he prints in italics: "*Umbellis masculis minutissimis, capituliformibus ad basin umbellarum feminearum, brevissime pedunculatis, pedunculo basi dilatato floribus vix conspicuis; antherarum filamentis crassis perbrevibus; involucris involucellisque nullis.*" In the various species we have examined these clusters of minute flowers appear to be always abortive, and the lateral umbels usually male, with scarcely any rudiments of gynæcium; while the central umbels are bisexual, though functionally female.

FERULA SZOVITSIANA, DC.; Boiss. Fl. Or. ii. p. 994.

Hari-rud valley: 277, April 19, 21, 1885; May 10, 12, 1885. A rigid herb, scarcely two feet high; common in the stony country and gravelly plains. The root-stock possesses a slight odour of assafœtida.

FERULA OVINA, Boiss. Fl. Or. ii. p. 986.

Badghis: 525, May 21, 25, 1885. Native name *Stourga, Kema-kohi.* A very characteristic plant about three feet in height, covering large expanses of the hill-sides in the Badghis, at an altitude of above 3000 feet. Is considered excellent grazing for all animals, and very fattening for horses.

FERULA FŒTIDA, Regel; Aitchison, Pharmac. Journ. & Trans. 3rd ser. xvii. p. 465 (Lond. 1887). (Plates XII., XIII., XIV.) *F. Scorodosma,* Bentley & Trimen; *Scorodosma fœtidum,* Bunge, Boiss. Fl. Or.; *Ferula Asafœtida,* Boiss. Fl. Or. ii. p. 994.

Native names: *Anguza-kema, Kurne-kema, Khora-kema.* Stems from three to five feet in height, from a perennial root-stock that produces annual radical leaves for several years, and then a flowering-stem, and upon the fruit ripening the plant dies. The young flowering-stem, rising from a tuft of radical leaves, appears in the form of a cabbage, being at first wholly enclosed in the broad stipular expansions, or bracts, to which the cauline leaves are reduced; and when the growing branches of the inflorescence first push them open, the whole plant somewhat resembles a cauliflower.

The stem seems out of all proportion massive, pillar-like, and stout for the plant. The inflorescence is globose, and from one to two feet in circumference. The flowers are white, and the young fruit soon takes a more or less purplish tinge.

In all stages of its growth, every part of the plant exudes upon abrasion a milky juice, which is collected, and constitutes the drug of commerce called Asafœtida, *Anguza, Hing.* The stem in a young state is eaten raw, or cooked.

FERULA GALBANIFLUA, Boiss. et Buhse, Aufz. p. 99; Boiss. Fl. Or. ii. p. 988; Aitchison, Pharmac. Journ. & Trans. 3rd ser. xvii. p. 466 (Lond. 1887). (Plates XV., XVI., XVII.) (Descript. amplific.) Caulis simplex, medio 2–3 poll. crassus sursum sensim attenuatus, inter nodos cavus. *Folia* radicalia petiolata, circiter 1½–2 ped. longa et 1–1½ ped. lata. *Inflorescentia* ampla, terminalis, subverticillatim ramosa, ramis pluriumbellatis; umbellæ centralessæpissime femineæ, laterales masculæ. *Petala* ampla, fere plana, extus arachnoido-pilosa.

Hari-rud valley: 237, April 15, 19, 1885; May 10, 1885; Badghis, May 16, 1885. Native name *Badra-kema, Bi-ri-jeh.* One of the Umbelliferæ which are so characteristic of the flora, growing like several others gregariously, no other plants being visible over large expanses of country. This was the one that was so common around Gulran, of the young foliage of which the camels made havoc. Owing to the minute divisions of the leaves we called this the parsley-leaved *Ferula.* It was the first to show its leaves in spring, and when its radical leaves were perfect and fresh, they formed round the stem what appeared like a cushion of soft moss.

The stem shoots up very rapidly and is hollow throughout its whole length. It rapidly tapers upwards and bears a most lovely loose panicle of orange-coloured flowers. At this stage the stem is orange-coloured and has a transparent appearance, subsequently assuming a more or less ruddy autumnal tint. From the very first an orange-coloured creamy juice exudes from any injured part; but wherever I saw the thickened juice on the stem, the injury had not been caused by an insect, but by some accident to the plant. The usual place to find the gum is at the base of the stem, where, owing to the violence of the wind being most felt, the bark cracks, and beneath this the gum collects, usually in contact with the stems of the radical leaves and the soil. The native name for the gum is *Jao-shir.*

We have seen only a small portion of a leaf and a fruit-bearing umbel of Boissier's var. β *Aucheri* of this species, and our plant has hollow, not solid, stems, and conspicuously hairy, not glabrous, petals; yet we feel convinced that it is the same species. The stem may be solid at first, and as to the hairs on the petals, they appear to be very fugacious. It is the only species with such exceedingly small, short, hairy, ultimate leaf-segments that has come under our observation, and the fruit of our plant agrees exactly in shape and with the description of *F. galbaniflua.*

FERULA (§ EURYANGIUM) SUAVEOLENS, Aitch. et Hemsl., n. sp.; Aitch. Pharmac. Journ. *l. c.* p. 407. (Plates XX., XXI.) *Planta* perennis, monocarpica (?), undique glabra vel glabrescens, gummifera, radice crassissima. *Caulis* 4–5-pedalis, ad nodos incrassatus. *Folia radicalia* 1½–2 ped. longa (et forsan sæpius longiora), longe petiolata, tripartita, divisionibus pinnatifidis sæpius 5-lobatis, lobis crassiusculis oblongis vel ovali-oblongis ¾–1½ poll. latis decurrentibus interdum irregulariter paucicrenatis simul minutissime denticulatis subtus hispidulis. *Folia caulina* similia sed minus secta, superiora simpliciter pinnatifida longeque vaginata. *Inflorescentia* verticillatim ramosa, ramis sæpius 3–5-umbellatis; umbella multiradiata, centrali breviter pedunculata, feminea, lateralibus minoribus longe pedunculatis masculinis. *Flores* flavi; petala lata, vix apice inflexa; pistilli carpella semicircularia vel a latere leviter compressa, vittis solitariis vallecularibus maximis jam instructa, commisura 2-vittata. *Fructus* deest.

Khorasan; 1064, June 18, 1885. On the hills to the south of Bezd, at an altitude of 6000 feet, in shady places and in the vicinity of running water. The root is scented, and it is one of the kinds of *Sumbul* exported from Persia to Bombay by the Persian Gulf.

From the shape of the pistil and very young fruit, one would never suspect that the

mericarps could eventually be strongly dorsally compressed; but it may well be so, for *Ferula* (§ *Euryangium*) *Sumbul*, Hook. f., exhibits this peculiarity in a marked degree, and our plant is clearly allied to it, though readily distinguished by the much larger and broader segments of the leaves, and the verticillate branching of the inflorescence.

DOREMA AMMONIACUM, D. Don; Aitchison, Pharmac. Journ. & Trans. 3rd ser. xvii. p. 466 (Lond. 1887); Boiss. Fl. Or. ii. p. 1008. (Plates XXIII., XXIV., XXV.)—*Diserneston gummiferum*, Jaub. et Spach, Ill. Pl. Or. i. t. 40; *Dorema hirsutum*, Loftus ex Borsz. Ferul. p. 28.

Vittæ obsoletæ vel perobscuræ, nunquam latiusculæ.

Hari-rud valley: 422, May 10, June 6, July 26, 27, 1885. Native name *Kandal-kema, Ushak*. One of the characteristic plants of the country, which it covers in some places to such an extent that on looking round one can see nothing else, and no limit to it. The radical leaves are very large and very similar to those of *Ferula fœtida*, Regel; and both plants on being injured yield a milky juice before the flower-stem is thrown up. Without the aid of smell, it was almost impossible to tell which plant one was looking at. However, the moment the plant begins to throw up its stem, there can be no doubt as to the genus. Unlike many species of *Ferula*, the inflorescence of the species of the present genus is unprotected by stipular expansions or foliaceous bracts. No sooner is the fruit well formed and beginning to ripen than the plant is attacked by some boring insect, which causes the milky juice to escape. This dries into hard blocks, frequently enclosing the fruit. The *Kandal, Ushak* or Ammoniacum is usually collected from the stem and frutescence, and often encloses clusters of the fruit.

A large series of sections was made of different carpels, and at all heights, but only faint traces of vittæ were observed, and these occurred irregularly; yet Borszczow (Ferula, t. 5) figures them comparatively wide.

DOREMA GLABRUM, Fisch. et Mey. Ind. Sem. Hort. Petrop. i. p. 26; Linnæa, x. (1835–36), Literatur-Ber. p. 88; Boiss. Fl. Or. ii. p. 1009. (Plates XXVI., XXVII.)—*D. Aucheri*, Boiss. in Ann. Sc. Nat. 3^{me} série, i. (1844), p. 329; *D. robustum*, Loftus in Borszc. Ferul. p. 28; *Ferula racemifera*, Szovits, MS., ex Borszcow.

Planta majestica usque ad 12-pedalem, foliis radicalibus amplissimis longe petiolatis, floribus polygamis.

Badghis: 462, May 14, 16, 1885. Native name *Kema-i-asp*. A gigantic plant growing in the beds of dried-up water-courses and forming a thicket with Tamarisk. The enormous pyramidal panicle covered with soft balls of brilliant yellow flowers could only be likened to *Acacia arabica* when in its full glory of inflorescence. It yields a yellow gum resin, but I did not hear of this being collected. As a rule all the outer flowers on the stems are male, those closer to the main stem being female; and it is the male flowers that make the great show in the inflorescence.

DOREMA SERRATUM, Aitch. et Hemsl., n. sp. (Plate XXVIII.) *Planta* monocarpica, perennis, undique glaberrima, albicans radice crassa. *Caulis* inferne simplex, 4–6-pedalis, lævis, demum candicans, nitidus. *Folia radicalia* petiolata, trifoliolata; foliola lateralia subsessilia, intermedium longiuscule petiolulatum, omnia crassiuscula, leviter inæqualia, oblonga vel ovali-oblonga, 6–9 poll. longa, apice rotundata,

basi subcuneata, interdum inæqualia, eleganter rigideque serrata, simul minutissime denticulata, costa crassa subtus elevata, venis laxe reticulatis; petiolus crassiusculus, 4–5 poll. longus, parvivaginatus. *Folia caulina* similia sed subpinnata, magnivaginata, foliolis 2-inferioribus multo majoribus petiolulatis, vaginis caulem arcte involventibus. *Inflorescentiæ* rami primarii divaricati, verticillatim dispositi et in apice caulis aggregati, simplices vel pauci-ramulosi; umbellæ breviter pedunculatæ, secus ramos sæpius ternatim dispositæ, pedicelli 1–1½ lineas longi. *Flores* non visi. *Fructus* obovato-oblongus, 6–7 lineas longus; vittæ omnino obsoletæ; carpophorum bipartitum.

Hari-rud valley: 718, July 25, 1885; Badghis: 476, May 16, 1885. This is an extremely common plant in the Badghis, where I only saw it in a very young state. I missed it completely in its flowering condition. However, I am glad to say that there are young plants of it in the gardens at Kew, which looked flourishing when I last saw them.

Zozimia absinthifolia, Vent.; Boiss. Fl. Or. ii. p. 1037.

Badghis: 367, May 1, 16, 1885. Native name *Zardak-kohi*, *Trak-mastar*, *Terek-mustar*. A very common and well-known herb, of which the leaves and root are eaten, both raw and cooked, by the people of the country. Extends throughout the Badghis and the Hari-rud valley into Khorasan.

Johrenia platypoda, Aitch. et Hemsl., n. sp. (Plate XXIX.) *Herba* perennis, erecta, undique glaberrima, radicibus fasciculatis carnosis clavatis. *Caulis* graciliusculus, teres, 2½–3-pedalis, sursum ramosissimus, ramulis ultimis gracillimis. *Folia* 5–8 poll. longa, breviter petiolata, circumscriptione deltoidea, triternato-pinnatisecta, segmentis ultimis linearibus vel filiformibus 6–9 lineas longis; foliorum caulinorum vaginæ latæ, basi auriculatæ, marginibus demum (saltem in siccis) revolutis. *Umbellæ* valde inæqualiter 4–6-radiatæ, bracteis bracteolisque parvis linearibus; umbellulæ inæqualiter 5–8-radiatæ. *Flores* desunt. *Fructus* mericarpia obovato-oblonga, margine fungosa, jugis dorsalibus tenuibus; vittæ valleculares solitariæ, sat conspicuæ.

Hari-rud valley: 620, June 8, 1885. In clayey soil inundated with rain-water, growing in great expanses, and looking from the distance as if it were under cultivation. A plant from three to four feet in height, with very curious spongy roots, in addition to the ordinary fibrous roots.

In habit, and the very unequal umbels, this is very similar to *J. fungosa*, from which it is readily distinguished by its more finely cut leaves and relatively narrow fungous margin of the mericarps. It also approaches *J. Candollei*, but that has deeply furrowed stems.

Daucus Carota, Linn.; Boiss. Fl. Or. ii. p. 1076.

Hari-rud valley: 582, June 3, 1885. Native name *Zardak*. This is not an indigenous plant, but a weed and an escape from cultivation in cultivated land; whereas the plant I collected in the Kuram valley * was truly indigenous. The carrot is very extensively cultivated both in Afghanistan and in Persia.

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* Journ. Linn. Soc. (Bot.) xviii. (1881) p. 64.

CAUCALIS LATIFOLIA, Linn.—*Turgenia latifolia*, Hoffm.; Boiss. Fl. Or. ii. p. 1087.

Badghis: 479, May 16, 17, 1885. Very common in good soil.

PSAMMOGETON SETIFOLIUM, Boiss.; Fl. Or. ii. p. 1079; Aitchison, Pharmac. Journ. & Trans. 3rd ser. xvii. p. 467 (Lond. 1887).

Hari-rud valley: 335, April 27, 1885; May 10, 1885; June 3, 1885. Native name *Kara-bia*. Common over the whole country. The fruits largely collected and employed in native medicine.

PSAMMOGETON BITERNATUM, Edgew.; Hook. f. Fl. Brit. Ind. ii. p. 719.—*Psammogeton crinitum*, Boiss.; Fl. Or. ii. p. 1078.

Hari-rud valley: 742, July 7, 1885. Not common; about a foot in height; flowers tipped with magenta whilst in bud, this colour rapidly disappearing as the flowers expand. Boissier describes the plant as an annual; there are such specimens in the Herbarium at Kew, but it is sometimes biennial.

UMBELLIFERARUM GENUS? *Herba* perennis?, circiter bipedalis, omnino glaberrima, ramosissima, caule striato basi tantum foliato, ramulis gracilibus. *Folia* angusta, absque petiolo plano alato caule appresso 3–4 poll. longa, laxe bipinnatisecta, segmentis ultimis parvis angustis vix acutis. *Umbellæ* compositæ, sæpissime valde inæqualiter triradiatæ; involucri bracteæ 3, ovatæ, acutæ; umbellulæ paucifloræ, bracteolis latioribus, margine albo hyalinæ. *Flores* lutei, polygami; calycis dentes obsoleti; petala lata, apice acuminato-incurva. *Fructus* (maturus non visus) deorsum attenuatus; mericarpia æqualiter 5-alata, alis sinuatis; valleculæ conspicue univittatæ.

Hari-rud valley: 1063, June 5, 1885. In stony ground, common.

We have not succeeded in identifying this very distinct plant, and the fruit is in too young a state to determine the genus.

CAPRIFOLIACEÆ.

LONICERA NUMMULARIFOLIA, Jaub. et Spach; Boiss. Fl. Or. iii. p. 7, forma floribus majoribus.

Badghis: 395, May 5, 1885, 555, May 24, 1885; Khorasan: 674, June 16, 17, 18, 1885. Native name *Kulfa*, *Kalpa*. Usually met with as a shrub, but in certain localities it attains the dimensions of a small tree, with a short stem four to five feet in circumference, forming thin forests, at an altitude of about 5000 feet. Near Bezd and also on the Paropamisus range.

Specimen 674, collected June 17, 1885, has much smaller leaves than the type.

RUBIACEÆ.

GAILLONIA OLIVERII, A. Rich.; Boiss. Fl. Or. iii. p. 13.

Khorasan; 691, June 18, 1885; Hari-rud valley: 730, July 27, 1885. Very common; in dry shingle, old water-courses, and stony places generally. The annual shoots and woody root-stocks make excellent fuel.

GAILLONIA (§ MICROSTEPHUS) DUBIA, Aitch. et Hemsl., n. sp. (Plate XXX.) *Frutex* semipedalis ad sesquipedalem, dense ramosus, ramis teretibus, rigidis, scabridis. *Folia* opposita, crassiuscula, rigida, scabrida, apice aculeata, sessilia, linearia, 1–1½ poll. longa, margine arcte revoluta, costa crassa ; stipulæ parvæ, pallidæ, pergamentaceæ, mucronulatæ, petiolo basi brevissime conjunctæ. *Flores* dichotomo-cymosi, breviter pedunculati vel subsessiles, pallide rosei, 6–9 lineas longi ; calyx longe sericeo-pilosus ; corolla anguste infundibularis, extus pubescens, lobis oblongis apice inflexis. *Fructus* sericeus, calycis dentibus parvis coronatus.

Hari-rud valley : 602, June 5, 1885, August 1, 1885 ; Khorasan : August 19, 1885. A low, stiff undershrub, with numerous annual stems, a foot to two feet in height, from large woody root-stocks ; flowers salmon-coloured, mauve, or pink. In gravelly soil, in the most arid tracts of the country where nothing else seemed to be able to exist.

We advance this species with some doubts ; it is intermediate in character between *G. eriantha* and *G. incana*.

CALLIPELTIS CUCULLARIA, DC. ; Boiss. Fl. Or. iii. p. 83.

Badghis : 468, May 16, 1885 ; Khorasan : June 17, 1885. Common, from 3000 feet altitude and upwards.

RUBIA TINCTORUM, Linn. ; Boiss. Fl. Or. iii. p. 17.

Hari-rud valley : 255, April 16, 1885 ; Khorasan : June 22, 23, 1885. Native name *Rodang*. A plant extensively cultivated for its roots, which are largely employed in dyeing, and are exported for this purpose.

RUBIA FLORIDA, Boiss. Fl. Or. iii. p. 18.

Badghis : 338, April 29, 1885, May 20, 1885 ; Hari-rud valley : May 27, 1885. An undershrub, two to three feet in height, covered with a dense mass of leaves and greenish-yellow flowers. Common in rocky situations on the low hills, at 3000 feet elevation.

GALIUM TRICORNE, Stokes ; Boiss. Fl. Or. iii. p. 67.

Hari-rud valley : 228, April 13, 16, 1885. In cultivated land ; very common.

GALIUM APARINE, Linn. ; Boiss. Fl. Or. iii. p. 68.

Badghis : 1065, May 1, 1885.

GALIUM, sp.

Badghis : 346, April 29, 1885. Very common, in the shade of rocks, on the low hills. Dyes the hands a yellow-green in collecting.

ASPERULA TRICHODES, J. Gay ; Boiss. Fl. Or. iii. p. 31.

Khorasan : 738, July 3, 1885. In stony, gravelly soil ; very common.

ASPERULA ARVENSIS, Linn.—*Asperula setosa*, Jaub. et Spach ; Boiss. Fl. Or. iii. p. 30.

Paropamisus range : 564, May 25, 1885. On the Sang-i-khotal pass, at an altitude of 5000 feet elevation ; profuse in stony soil.

ASPERULA HUMIFUSA, Bieb., var. β. PYCNANTHA, Boiss. ? ; Boiss. Fl. Or. iii. p. 44.

Khorasan : 658, June 16, 1885. On the banks of streams, in stony places, above 3000 feet altitude ; common.

Crucianella glauca, Rich.; Boiss. Fl. Or. iii. p. 24.

Badghis: 488, May 17, 1885. In large quantity, on the top and northern exposure of Mount Sim-koh, at an altitude of 3500 feet.

Var. β. **laxiflora**, Boiss. Fl. Or. iii. p. 25.

Khorasan: 672, June 17, 1885. A weed in cultivated soil, at an altitude of 5000 feet.

Crucianella filifolia, Regel et Winkler in Herb. Kew.; cf. Acta horti Petrop. iii. p. 419, n. 2526, Regel et Schmalh. ?

Hari-rud valley: 580, May 28, 1885. An excessively common, erect, rather stiff annual, in gravelly soil. Flowers yellowish green.

VALERIANEÆ.

Valerianella diodon, Boiss. Fl. Or. iii. p. 99.—*V. oxyrrhyncha*, var. *diodon*, Krok.

Hari-rud valley: 1066, May 10, 1885.

Valerianella Dufresnia, Bunge; Boiss. Fl. Or. iii. p. 109.

Hari-rud valley: 1067, May 9, 1885. Common, growing under shrubs, in loamy soil.

Valerianella, sp.

Hari-rud valley: 215, April 13, 19, 1885.

Valerianella, sp.

Hari-rud valley: 1068, April 17, 18, 19, 1885. Occasional, under bushes in loamy soil.

DIPSACACEÆ.

Cephalaria syriaca, Schrad.; Boiss. Fl. Or. iii. p. 120 (*Scabiosa*, Linn.).

Hari-rud valley: 587, June 3, 1885. A common weed in corn-fields.

Scabiosa Olivieri, Coult.; Boiss. Fl. Or. iii. p. 141.

Hari-rud valley: 453, May 12, 1885; 578, May 28, 1885; July 27, 1885. Extremely common in stony ground over the whole country.

Scabiosa rotata, Bieb., var.; Boiss. Fl. Or. iii. p. 145.

Hari-rud valley: 424, May 10, 1885. Very common, in stony soil; flowers whitish grey.

The segments of the calyx in these specimens are included well within the involucre, not exserted, as in the type.

COMPOSITÆ.

Aster, sp.

Khorasan: 789, August 21, 1885.

Pluchea Caspia, Benth. in Journ. Linn. Soc. xiii. p. 416.—*Karelinia Caspia*, Less.; Boiss. Fl. Or. iii. p. 218.

Khorasan: 786, August 20, 1885; Helmand: 90, October 28, 1884. Extremely local, occurring near water, on the edges of fields and margins of irrigation-channels; it grows in thick dense clumps of from 3 to 4 feet in height, and makes excellent cover for Black Partridge, as at De-doda and Ibrahim-a-bad. The surfaces of the leaves are vertical.

IFLOGA FONTANESII, Cass.—*Trichogyne cauliflora*, DC.; *Ifloga spicata*, Schrad.; Boiss. Fl. Or. iii. p. 248.

Northern Baluchistan: 44, October, 1884. In sandy soil, common.

INULA RUPESTRIS, Aitch. & Hemsl., Journ. Linn. Soc. xix. p. 169.

Khorasan: 808, August 27, 1885. In quantity, in hot exposed country, on broken limestone rock.

CODONOCEPHALUM PEACOCKIANUM, Aitch. et Hemsl., n. sp. (Plates XXXI. & XXXII.)

Herba robusta, ramosa, 5 ped. alta, grandifolia, fere omnino glabra. *Folia* crassiuscula, prominenter laxe reticulato-venosa, primum subtus præcipue secus costam crassam puberula, oblongo-ovalia, obtusissima, sinuata, ceterum integra; radicalia petiolata; caulina sessilia, amplexicaulia, basi auriculata, auriculis rotundatis. *Capitula* $\frac{3}{4}$–1 poll. longa, laxissime corymbosa, alia sessilia alia pedunculata; involucri bracteæ pluriseriatæ, rigidæ, acutissimæ, ciliolatæ, exteriores breviores; receptaculum areolatum, fimbrilligerum. *Achænia* (matura non visa) puberula, striata; pappus breviter pilosus.

Khorasan: 646, June 16, 17, 1885; July 19, 1885. Native name *Landar*. A very characteristic herb of the country, covering immense tracts in the Badghis and Khorasan at an altitude of 3000 feet; the large perennial root-stocks throw up great stout annual shoots five feet in height, covered with leaves, some of which are fully two feet long; they form a dense close cover unmixed with any other plants, in a rich soil where water is not far from the surface. This herbage is greedily eaten by goats and sheep, so much so that I had some difficulty in getting flowering and fruiting specimens.

Easily distinguished from *C. inuloides*, the only other species, by its sessile cauline leaves, and loosely corymbose inflorescence. Moreover, the pappus is not so distinctly plumose.

VICOA PENTANEMA, Aitch. & Hemsl.—*Pentanema divaricatum*, Cass.; *Inula divaricata*, Boiss. Fl. Or. iii. p. 200.

Khorasan: 784, August 19, 1885. Near water, amongst grass, in stony soil.

The specific name *divaricata* could not be applied to this species, as it had already been appropriated for an African species.

PULICARIA FOLIOLOSA, DC.; Hook. f. Flora British India, iii. p. 298.

Hari-rud valley: 761, August 3, 1885. In the beds of dry water-courses; common. Flowers dull yellow.

PULICARIA GNAPHALODES, Boiss. Fl. Or. iii. p. 203.

Khorasan: 804, August 27, 1885. Local, on hot pulverized limestone in extremely bare soil. Exquisitely scented, somewhat like lemon-Verbena, but more powerful.

ACHILLEA SANTOLINA, Linn.; Boiss. Fl. Or. iii. p. 266.

Paropamisus range: April 2, 1885; Hari-rud valley: 434, May 10, 1885. In clayey soil, extremely common.

ACHILLEA MICRANTHA, Bieb.; Boiss. Fl. Or. iii. p. 264.

Badghis: 541, May 22, 1885. In meadow-land, near water, where Orchis grows; a very handsome and showy species.

ANTHEMIS CAULESCENS, Aitch. et Hemsl., n. sp. (Plate XXXIII.) *Herba* perennis, 1–2-pedalis (forsan interdum ultra) cano-pubescens, caule basi simplice sursum divaricatim ramosa. *Folia* petiolata vel subsessilia, inferiora 3–9 poll. longa, 2–3-pinnatipartita, segmentis ultimis parvis linearibus acutis. *Capitula* numerosa, longe pedunculata (pedunculis bracteis parvis instructis), discoidea, hemisphærica; involucri bracteæ pauciseriatæ, ovato-oblongæ, obtusæ, arcte appressæ, incurvæ; receptaculi paleæ lineares vel filiformes, flores paullo breviores. *Flores* flavi, omnes tubulosi, parcissime papillosi. *Achænia* glabra, matura non visa.

Badghis: May 4, 1885; Hari-rud valley: 610, June 6, 1885. An occasional plant, spread generally over the country. Leaves strongly scented.

This is quite unlike any other species of *Anthemis*, yet we think it can belong to no other genus.

MATRICARIA LASIOCARPA, Boiss.; Fl. Or. iii. p. 324.

Hari-rud valley: 198, April 7, 16, 17, 1885. This is an extremely common species, growing usually in loamy soil, under the shade of shrubs.

TANACETUM UMBELLIFERUM, Boiss.—*Pyrethrum umbelliferum*, Boiss. Fl. Or. i. p. 352.

Hari-rud valley: 460, May 13, 1885; Badghis: May 20, 22, 1885. On the rolling downs of the Badghis; very common in certain localities. A very showy species.

ARTEMISIA CAMPESTRIS, Linn., var.; Boiss. Fl. Or. iii. p. 363.

Hari-rud valley: 609, June 6, 1885; 735, July 27, 1885. This and *A. maritima* are the two most characteristic plants of the great gravel- and boulder-plains of the whole country. Native name for both *Trek*. They have large woody root-stocks from which numerous annual stems spring; these annual shoots form the chief camel-fodder of the arid tracts of the country, and the woody root-stocks are splendid fuel. The two plants are easily distinguished from each other when growing; this species having white stems and the general aspect of the plant grey, whereas the stems of the other are deep red, almost black.

At first sight this is so unlike European *A. campestris* that one would take it for a distinct species. The foliage is much reduced, and the slender red-brown, eventually shining stems and branches are woody and wiry. The same state is in the Kew Herbarium, collected by Griffith (547), and it was named *A. campestris* by the late Mr. Bentham. Mr. C. Winkler, Curator of the St. Petersburg Herbarium, who obligingly compared a number of our Compositæ with Turkestan types, independently arrived at the same conclusion.

ARTEMISIA MARITIMA, Linn.; Boiss. Fl. Or. iii. p. 366.

Hari-rud valley: 370, May 1, 1885: 734, July 27, 1885. Native name *Trek*. With *A. campestris* characteristic of the whole country, growing in the most arid parts; constituting the chief camel-fodder, and valued for fuel.

ARTEMISIA SCOPARIA, Waldst. et Kitaib; Boiss. Fl. Or. iii. p. 364.

Khorasan: 807, August 27, 1885. Very seldom seen, but occasional in the Hari-rud valley.

SENECIO CORONOPIFOLIUS, Desf.; Boiss. Fl. Or. iii. p. 390.

Hari-rud valley: 197, April 7, 13, 11, 1885. Common in the shelter of bushes and in cultivated soil.

DIPTEROCOME PUSILLA, Fisch. et Mey.; Boiss. Fl. Or. iii. p. 420.

Hari-rud valley: 447, May 12, 1885. In clayey soil, common.

GUNDELIA TOURNEFORTII, Linn.; Boiss. Fl. Or. iii. p. 421.

Badghis: 543, May 22, 1885; Khorasan, June 16, 1885. Native name *Kangar*. This, like *Codonocephalum Peacockianum*, occupies vast tracts of country, its size depending greatly on the soil and locality; but it averages from two to four feet in height. It is of spreading habit, and the radical leaves alone often measure three feet, and stick out like bayonets. It forms dense impassable thickets, owing to its stout hard spines. In autumn it is collected and stored, as we do hay, for fodder for cattle. When dry it easily breaks up, and is then very like crushed straw fodder.

ECHINOPS GRIFFITHIANUS, Boiss. Fl. Or. iii. p. 434?

Khorasan: 705, June 30, 1885. In shingle, common.

CHARDINIA XERANTHEMOIDES, Desf.; Boiss. Fl. Or. iii. p. 446.

Hari-rud valley: 334, April 27, 1885; Badghis, May 16, 1885. A very common plant; flowers somewhat tinged with rose when collected.

THEVENOTIA SCABRA, Boiss. Fl. Or. iii. p. 455.

Hari-rud valley: July 31, 1885; Khorasan: 1069, August 24, 1885. A very local plant, characteristic of clayey plains; widely scattered, singly and in pairs.

COUSINIA MICROCARPA, Boiss. Fl. Or. iii. p. 496.

Badghis: 498, May 18, 21, 1885; Khorasan, June 6, 1885. Very common. This plant varies in size from eight inches to a spreading bush of three to four feet.

COUSINIA DESERTI, Bunge; Boiss. Fl. Or. iii. p. 468.

Hari-rud valley: 740, July 28, 1885; Khorasan: 621, June 9, 1885. Characteristic of the arid desert country in shingle, associated with other species of *Cousinia* and *Artemisia*. The annual shoots and leaves are very brittle, and easily swept off by the wind. Flowers yellow, tipped with purple. This is the Holly-leafed Thistle of the Mission.

Cousinia alata, C. A. Mey.; Boiss. Fl. Or. iii. p. 478.

Hari-rud valley: 577, May 28, 1885; June 5, 1885. Most common all over the gravelly country.

Cousinia uncinata, Regel.—*Cousinia umbrosa,* Bunge; Boiss. Fl. Or. iii. p. 463.

Badghis: 508, May 18, 1885; Mt. Do-shakh: 767, August 5, 1885. Our plant is certainly *C. uncinata,* Regel, which is probably *C. umbrosa,* Bunge; but we have no authenticated specimens of Bunge's plant to refer to. It is a tall graceful plant with very large leaves, and presents a general resemblance to *Arctium.*

It occurs in moist meadow-land, in the shade of rocks and trees; except in such localities, not common.

Cousinia aptera, Aitch. & Hemsl.; Journ. Linn. Soc. Bot. xix. p. 171.

Khorasan: 712, July 18, 1885. In stony exposed barren soil, at an altitude of 4500 feet; very common.

Cousinia congesta, Bunge; Boiss. Fl. Or. iii. p. 469.

Hari-rud valley: 598, June 4, 5, 1885. Very characteristic of the gravel and shingle plains of the arid tracts of the country; growing three feet in height. It has a peculiar woolly crown, or ring, round the base of the annual stem. This ring is formed by the bases of the petioles of the root-leaves, which persist and form a covering for the crown of the following year's stem.

Cousinia eryngioides, Boiss. Fl. Or. iii. p. 490.

Khorasan: 631, June 13, 1885. In stony and gravel slopes, at an altitude of 3000 feet; growing gregariously over a great extent of country. It is almost impossible to ride through an undergrowth of this, owing to the great spinous pliant heads striking the horses, and driving them almost mad.

Cousinia tenella, Fisch. et Mey.; Boiss. Fl. Or. iii. p. 494.

Hari-rud valley: 432, May 10, 16, 1885. A common weed in the vicinity of cultivation and in cultivated soil. By its semiscandent habit it forms itself into dense masses over shrubs.

Cousinia arctotidifolia, Bunge, var.; Boiss. Fl. Or. iii. p. 499.

Khorasan: 622, June 9, 1885. The radical leaves not so deeply pinnatifid as in the specimens originally described. Common over the whole country, on shingle, &c.

Cousinia heterophylla, Boiss. Fl. Or. iii. p. 470.

Hari-rud valley: 753, July 1885. One of the characteristic plants of the gravelly and stony desert country, having large spongy root-stocks that make capital fuel. It has a very oak-like grey leaf, and is the Oak-thistle of the Mission.

Cousinia minuta, Boiss. Fl. Or. iii. p. 489.

Hari-rud valley: 448, May 12, 1885; June 6, 1885. Common everywhere; and varying extremely in leafiness, which depends whether it grows in dry gravelly soil or in moist meadow-land.

COUSINIA CHAMÆPEUCE, Boiss. Fl. Or. iii. p. 465.

Badghis: 486, May 17, 1885; 515, May 19, 1886. Very common on dry clayey hills and banks, and remarkable for its large woolly flower-heads.

COUSINIA, sp.

Hari-rud valley: 1070, July 26, 1885. In gravelly plains; common.

COUSINIA (§ SERRATULOIDEÆ, Bunge ?) WINKLERIANA, Aitch. et Hemsl. *Herba* perennis, rigida, pedalis ad sesquipedalis, canescens, tarde glabrescens, caulibus pauciramosis oligocephalis. *Folia* rigidissima (radicalia non visa), oblonga, usque ad 4 poll. longa, plana, arcte ad ramos appressa, longe lateque decurrentia, elevato-venosa, secus margines tantum longiuscule rigideque aculeata. *Capitula* sparsa (ramulis sæpius tricephalis), lateralia sessilia, terminalia breviter pedunculata, arachnoideo-tomentosa, multiflora, ovoidea ore constricto; involucri bracteæ numerosissimæ, exteriores atque intermediæ breves, angustissimæ, spiniformes, arcte appressæ, interiores glaberrimæ, cartilagineæ, lineares, acutissimæ, 10–15 lineas longæ; receptaculi setæ fere filiformes, achæniis cum pappo longiores. *Achænia* ecostata, compressa, obovata, apice rotundata, glabra, opaca, obscure maculata; pappi setæ breves, sæpius bistortæ, longe bifariam barbellatæ.

Hari-rud valley: 759, August 3, 1885. Very common in gravelly and clayey plains.

We have much pleasure in naming this after Mr. Const. Winkler, Curator of the St. Petersburg Herbarium, who compared this and other Compositæ with Turkestan species not represented in the Kew Herbarium.

COUSINIA CYNAROIDES, C. A. Mey.; Boiss. Fl. Or. iii. p. 506, var. foliis radicalibus a forma typica diversa.

Hari-rud valley; 601, June 4, 1885; Khorasan: 1079, June 21, 1885. Very common in stony ground and shingle. The plant has a general grey appearance, from the woolly tomentum with which it is covered.

We have followed Mr. C. Winkler's suggestion in referring this to *C. cynaroides*, as we have only seen Hohenacker's Caucasian specimens.

COUSINIA, sp.

Badghis: 365, May 1, 1885. Native name *Pulush*. A perennial with numerous creeping root-stocks, which throw up annual flowering-stems, three to four inches in height, with numerous clusters of leaves. The plant grows in large irregular patches, and is of a remarkable grey colour, rendering it very conspicuous at a distance. It is found in rocky places on the low hills above 3000 feet. It would, we think, prove a good plant for garden purposes.

COUSINIA, sp. Cousinia "nova species, *C. arachnoideæ*, Fisch. et Mey., valde affinis (an potius forma glabriuscula hujus speciei ?)."—*C. Winkler* in litt.

Hari-rud valley: 596, June 4, 1885. One specimen only. A plant three feet in height; flowers yellow.

The inner involucral bracts of *C. arachnoidea* are conspicuously dilated, scarious, and coloured at the tips, while in this they are not; hence we suspect a different species may have been sent to St. Petersburg under this name.

CARDUUS PYCNOCEPHALUS, Jacq.; Boiss. Fl. Or. iii. p. 520.

Hari-rud valley: 437, May 11, 1885. A troublesome weed in cultivated land.

CNICUS ACARNA, Linn.—*Cirsium Acarna*, Mœnch; Boiss. Fl. Or. iii. p. 549.

Hari-rud valley: 750, July 30, 1885. On the margins of cultivation; common, in good soil.

CNICUS ARVENSIS, Hoffm.—*Cirsium arvense*, Scop.; Boiss. Fl. Or. iii. p. 552.

A common weed, in cultivated land.

ONOPORDON LEPTOLEPIS, DC.?; Boiss. Fl. Or. iii. p. 564.

Khorasan: 704, June 30, 1885. Our plant is identical with Griffith's specimens numbered 680 and 932, and Stocks's 1066. We have seen no authenticated specimens of *O. leptolepis*, and Boissier does not mention Griffith and Stocks's specimens. It is a very characteristic plant of these regions, being common in the Hari-rud valley as well as in Khorasan, growing in gravelly soil. It reaches five feet in height, is slender in habit, and covered with large extremely showy flower-heads.

JURINEA VARIABILIS, Aitch. et Hemsl., n. sp. (Plate XXXIV.) *Herba* perennis?, 6–18 poll. alta, caule tantum infra medium foliosa, sæpius tricephala, ad collum lanata. *Folia* lanceolato-oblonga, usque ad 4 poll. longa, integra, dentata vel alte pinnatifida, præcipue subtus cano-lanata; radicalia in petiolum attenuata; caulina sessilia, amplexicaulia. *Capitula* usque ad 1½ poll. diametro; involucri bracteæ pluriseriatæ, rectæ, acutissimæ, glabrescentes, extimæ brevissimæ, longiores, roseæ; receptaculi squamæ vere paleaceæ, acutæ, acheniis duplo triplove longiores. *Achænia* (matura non visa) lævia, glabra, pappo multoties breviora; pappus copiosus, longe plumosus, setis 2–5 interioribus longioribus.

Paropamisus range: 572, May 26, 1885. Common everywhere. Sheep do not eat it.

Allied to *J. adenocarpa* and *J. chætocarpa*, differing in its relatively naked, smooth achenes. The accessible material is too scanty to allow of our testing the constancy of these characters. Our plant is identical with Griffith's no. 3317.

JURINEA MONOCEPHALA, Aitch. et Hemsl., n. sp. Affinis *J. variabili*, differt foliis linearibus vel lineari-lanceolatis, collo vix lanato, caulibus monocephalis, involucri bracteis brevioribus, patentibus, achæniis longioribus, pappo breviore minus plumoso.

Khorasan: 682, June 18, 1885. In shady localities, on limestone rock, at an altitude of 5000 feet; growing in patches, and the thick, close clumps of its broad leaves matted together look like turf, from which the tall slender-stemmed handsome flower-heads spring.

CENTAUREA (§ MICROLOPHUS) PLUMOSA, Aitch. et Hemsl., n. sp. *Herba* perennis vel biennis, erecta, 1–2-pedalis, fere omnino glaberrima, pauciramosa, ramis sulcatis mono-

cephalis erectis. *Folia* radicalia breviter petiolata, caulina sessilia, plus minusve oblique decurrentia, omnia coriacea, pallida, rigida, oblonga, maxima 6 poll. longa, sæpius integra, undulata, utrinque prominentia laxeque reticulato-venosa. *Capitula* citrina, fere cylindrica, 1½–2 poll. longa, pedunculis parvi-foliosis; involucri bracteæ pluriseriatæ, appressæ, coriaceæ, primum puberulæ vel scaberulæ, acutæ vel subaculeatæ, exteriores brevissimæ, ovato-oblongæ, interiores subscariosæ, lineares, usque 15 lineas longæ; flores homomorphi, 5–6 lineas exserti; receptaculum planum, paleis numerosissimis angustissimis circiter 9 lineas longis instructum. *Achænia* glabra (matura desunt), leviter costata, 3–4 lineas longa; pappi setæ numerosissimæ, inæquales, longiuscule plumosæ, longiores 9 lineas longæ.

Near *C. alata*, Lam., in the cauline leaves and flower-heads; but the latter are fewer and larger, and the achenes and pappus are wholly different.

Khorasan: 667, June 17, 1885. A weed, in fields, at an altitude of 5000 feet, having large, handsome, lemon-coloured flower-heads.

CENTAUREA PHYLLOCEPHALA, Boiss. Fl. Or. iii. p. 684.

Badghis: 480, May 16, 1885; Hari-rud valley: 595, June 3, 1885. Abundant everywhere, but especially so near villages. Its habit of growth is very varied, as in gravel soil and in the arid country it lies flat on the ground, while in moist ground it is an erect bush almost three feet high.

CENTAUREA VIRGATA, Lam.; Boiss. Fl. Or. iii. p. 651.

Khorasan: 690, June 18, 1885, July 1, 1885. Very common, in all sorts of soil, throughout the Hari-rud valley, as well as in Khorasan.

CENTAUREA BALSAMITA, Lam.; Boiss. Fl. Or. iii. p. 679.

Khorasan: 630, June 15, 1885. Common in cultivated soil.

CENTAUREA DEPRESSA, Bieb.; Boiss. Fl. Or. iii. p. 635.

Hari-rud valley: 223, April 13, 1885, June 5, 1885. A very attractive and characteristic weed in corn-fields.

CENTAUREA PULCHELLA, Ledeb.; Boiss. Fl. Or. iii. p. 620.

Hari-rud valley: 288, April 21, 1885, May 28, 1885; Badghis: May 16, 1885. Common in shingle and stony soil.

CENTAUREA PICRIS, Pall.—*Acroptilon Picris*, DC.; Boiss. Fl. Or. iii. p. 612.

Hari-rud valley: 1071, June 3, 1885; Khorasan: June 21, 1885. Excessively common, on the margins of fields and sides of irrigation-channels.

CENTAUREA MOSCHATA, Linn.—*Amberboa moschata*, Boiss. Fl. Or. iii. p. 605.

Hari-rud valley: 262, April 17, 18, 19, 1885; May 10, 13, 1885. Native name *Mai-i-mesh.* Very common in shade.

CENTAUREA ALBISPINA, Aitch. & Hemsley.—*Microlonchus albispinus*, Bunge; Boiss. Fl. Or. iii. p. 701.

Hari-rud valley: 428, May 10, 1885. Very local in gravelly soil on the sides of low hills near Tirphul. The flowers vary from white and yellow to pink.

CENTAUREA IBERICA, Trevir.; Boiss. Fl. Or. iii. p. 690.

Hari-rud valley: 605, June 5, 1885. Common in cultivated ground near villages.

CARTHAMUS TINCTORIUS, Linn.; Boiss. Fl. Or. iii. p. 709.

Khorasan: 792, August 23, 1885. Native name *Kajura*. Cultivated in Afghanistan as well as Khorasan for the dye-stuff obtained from the flowers.

CARTHAMUS OXYACANTHA, Bieb.; Boiss. Fl. Or. iii. p. 709.

Hari-rud valley: 589, June 3, 1885; Khorasan, June 21, 1885. Very common.

CICHORIUM INTYBUS, Linn.; Boiss. Fl. Or. iii. p. 715.

Khorasan: 697, June 21, 1885. Native name *Kashni*. In loamy soil common everywhere; also cultivated in gardens as a pot-herb.

KOELPINIA LINEARIS, Pallas; Boiss. Fl. Or. iii. p. 721.

Hari-rud valley: 282, April 19, 21, 26, 1885. Very common amongst boulders in gravelly soil.

RHAGADIOLUS HEDYPNOIS, Fisch. et Mey.—*Garhadiolus Hedypnois*, Jaub. et Spach; Boiss. Fl. Or. iii. p. 723.

Badghis: 363, May 1, 1885.

HETERACIA SZOVITSII, Fisch.; Boiss. Fl. Or. iii. p. 724.

Hari-rud valley: 426, May 10, 1885; Badghis: May 20, 1885. Common in stony soil.

CREPIS STOCKSIANA, Aitch. & Hemsl.—*Heteroderis Stocksiana*, Boiss. Fl. Or. iii. p. 794.

Hari-rud valley: 324, April 26, 1885, May 9, 10, 28, 1885; 602, June 5, 1885; Khorasan: June 21, 1885. In loamy soil near the roots of shrubs.

PTEROTHECA FALCONERI, Hook. fil. Flora British India, iii. p. 399.

Hari-rud valley: 293, April 21, 1885, May 10, 1885. Abundant, in gravelly soil, on low hills.

TARAXACUM OFFICINALE, Web.; Boiss. Fl. Or. iii. p. 787.

Badghis: 110, January 20, 1885; Hari-rud valley: April 2, 1885. Generally distributed, wherever there is moist soil, over the whole country.

LACTUCA LONGIROSTRA, Aitch. et Hemsl., n. sp. *Herba* annua, undique fere glabra vel glabrescens, a basi ramosa, 3–6 poll. alta. *Folia* radicalia rosulata, obovato-spathulata, $\frac{3}{4}$–2 poll. longa, irregulariter dentata vel plus minus lobulata, simul denticulata, supra glabra, subtus pilis longis albis parce instructa; folia caulina subnulla vel parva, amplexicaulia. *Capitula* numerosa, circiter 10-flora, 6–8 lineas longa; involucri bracteæ 10–12, extimæ minimæ, calyculatæ, intimæ lineares, vix acutæ. *Achænia* pallida, obovato-oblonga, valde compressa, medio leviter 1-costata, transversim striatula, margine incrassata, obscure muriculata; pappus breviter exsertus, brevis, longirostratus; rostrum quam achænium fere triplo longius.

Hari-rud valley: 416, May 10, 1885. This is near *L. undulata*, Ledeb., and also to *L. canescens*. Winkler writes "*Lactuca* nova species a *L. undulata*, Ledeb., cui proxima, foliis cuneatis subtus pilis parcis scabris differt. *L. canescens*, Regel et Schmalh., foliis involucri phyllisque scabris (ut species nova) foliorumque forma et habitu persimilis, differt achæniis muricato-scabris, rostro triplo breviore."

An annual, from three to four inches in height, with numerous copper-coloured basal leaves and a large loose corymbose inflorescence.

Lactuca orientalis, Boiss. Fl. Or. iii. p. 819.

Northern Baluchistan: 52, Oct. 9, 1884; Hari-rud valley: July 30, 1885; Khorasan: August 27, 1885. A characteristic shrub of the dry, arid, stony regions, from Baluchistan to the Hari-rud and Persia. Its branches so densely interlace that it forms a hard prickly ball.

Lactuca Scariola, Linn.; Boiss. Fl. Or. iii. p. 809.

Khorasan: 699, June 21, 1885. Common in cultivated soil, and in hedges near villages.

Lactuca persica, Boiss. Fl. Or. iii. p. 806.

Badghis: 366, 466, May 1, 14, 1885. A very handsome-flowered species; would be worth cultivating. It was in some quantity near the Nihal-sheni Pass.

Sonchus asper, Vill.; Boiss. Fl. Or. iii. p. 796.

Hari-rud valley: 455, May 12, 1885. Common.

Microrhynchus nudicaulis, Less.—*Zollikoferia nudicaulis*, Boiss. Fl. Or. iii. p. 824.

Hari-rud valley: 726, July 27, 1885.

Microrhynchus spinosus, Benth. & Hook. f., forma.—*Zollikoferia spinosa*, Boiss. Fl. Or. iii. p. 826; Aitch. in Trans. Pharmac. Soc. Lond. vol. xvii. (1887), p. 468.

Hari-rud valley: 723, July 26, 27, 1885. This is the same plant as 3373, and $\frac{715}{883}$ Griffith's Journal, and the same form as our plant is in the Herbarium at Kew from Persia, the Egyptian desert, and Syria. It differs from typical *M. spinosus* in its lateral capitula being on short scaly peduncles. Native name *Chirkah*. This and *Lactuca orientalis* are extremely characteristic of the arid gravelly tracts of the whole country, and form spinous balls, those of the present plant being larger and much laxer. *M. spinosus* yields a resinous exudation, which is collected for adulterating true *Anzerut*. This when freshly gathered has a most horrible odour like decaying animal matter.

Tragopogon coloratum, C. A. Mey.; Boiss. Fl. Or. iii. p. 746 (varietates).

Hari-rud valley: 325, April 26, 1885; Badghis: 1073, May 1, 4, 20, 1885. Profuse in sandy loam; flowers purple.

Native name *Gash-goshi*.

Tragopogon graminifolium, DC.; Boiss. Fl. Or. iii. p. 752.

Hari-rud valley: 459, May 12, 1885; Khorasan: 700, June 23, 1885, August 23, 1885. Very common in cultivated soil. Flowers yellow; heads closed during the heat of the day.

T. brevirostre, DC., *T. floccosum*, Kit., and *T. graminifolium*, DC., are so near each other that we are inclined to regard them as forms of one species.

Scorzonera tuberosa, Pall.; Boiss. Fl. Or. iii. p. 777.

Hari-rud valley: 192, April 7, 1885, May 9, 1885. Common. Bulbs of the size and somewhat of the form of a chestnut, with a yellow-ochre-coloured juice; eaten by the natives.

Scorzonera mollis, Bieb.; Boiss. Fl. Or. iii. p. 761.

Hari-rud valley: 1074, April 7, 15, 26, 1885, May 10, 1885. Native names *Kambul* and *Jhag*. Very common. With large roots, tuberous, irregular in shape, from two to three inches long, by an inch to one and a half inches broad. Both the bulbs and leaves largely collected and eaten; the leaves are usually cooked.

Scorzonera papposa, DC.; Boiss. Fl. Or. iii. p. 765.

Badghis: 483, May 17, 1885. In loose sandy gravel; by no means common.

Scorzonera pusilla, Pallas; Boiss. Fl. Or. iii. p. 771.

Hari-rud valley: 175, April 6, 19, 21, 1885, May 10, 1885. Very abundant, growing near the roots of bushes, in good soil; bulbs eaten.

Epilasia ammophila, Bunge; Hook. fil. Flora British India, iii. p. 419.

Hari-rud valley: 273, April 19, 21, 1885, May 12, 1885. Common in gravelly soil.

CAMPANULACEÆ.

Campanula incanescens, Boiss. Fl. Or. iii. p. 912.

Khorasan: 638, June 16, 1885. In the crevices of limestone cliffs, above 5000 feet altitude; only obtained near Bezd.

PLUMBAGINEÆ.

Acantholimon, sp. aff. *A. roseo*, Boiss. Fl. Or. iv. p. 853.

Hari-rud valley: 782, August 19, 1885. In stony ground on hill-sides, at an altitude of 3000 feet. A shrub about two feet in height, forming a dense spinous hassock, three feet across. The flowers of this species do not rise above the spiny branches.

Acantholimon (§ Armeriopsis) **Ecæ**, Aitch. et Hemsl., n. sp. (Plate XXXVI.) *Suffrutex* nanus, densissime ramosus, foliis semiteretibus, spiniformibus pollicaribus papillosis. *Flores* speciosi, in spiculas sæpius trifloras subcapitatim dispositi; scapus gracilis, 2–3-articulatus, simul parvi-bracteatus, 2–4 poll. longus; capitula circiter 8-spiculata; bracteæ exteriores latissimæ, truncato-rotundatæ, ecarinatæ, fere omnino scariosæ, emarginatæ, interiores longiores, præter carinam elevatam hirsutam scariosæ, bracteæ carina in mucronem distinctum producta; calyx cylindricus, bracteas paulo superans, climbatus, 5-costatus, inter costas breviter 5-lobatus, costis extus hirsutis breviter mucronatis; corolla ampla, rosea.

Badghis: 573, May 27, 1885. A small shrub, forming dense hummocks of a foot in height and a foot across. The flowers bright rose-pink, on peduncles three inches long; very common in rocky places, at an altitude of 3000 feet.

ACANTHOLIMON, sp.

Khorasan: 1075, July 1, 1885. A shrub, about two feet in height, forming hassocks as much as three feet in breadth. Only one set of poor specimens collected.

ACANTHOLIMON LONGIFLORUM, Boiss. Fl. Or. iv. p. 849.

Badghis: 400, May 5, 19, 20, 1885; Hari-rud valley: 408, May 9, 10, 1885. A low shrub, common in rocky places, forming very loose open soft hassocks; the flowers in loose panicles on long pliant peduncles, from four inches to over a foot in length. Flowers rose-coloured, large and distant.

ACANTHOLIMON (§ GLUMARIA) SPECIOSISSIMUM, Aitch. et Hemsl., n. sp. (Plate XXXV.)

Herba perennis, cæspitosa, graminifolia, ramis subelongatis, foliis vetustis refractis textis. *Folia* omnia plana, glauca, pulverulenta, scabrida, pungentia, inferiora latiora, breviora, crassiora, glabrescentia, cetera elongata, longiuscule lateque vaginantia. *Scapus* lateralis, circiter semipedalis, simplex vel 2–3-ramosus; spiculæ demum dissitæ, 2–3-floræ, sæpius 3-floræ, 3-bracteatæ, bracteis latis acerosis late scariosis. *Flores* splendide rosei, circiter 1 poll. diametro; calyx cylindricus, fere elimbatus, valide 10-costatus, costis distincte puberulis; limbi lobi scariosi, breves, acuti.

Badghis: 350, May 1, 1885; 512, May 19, 20, 21, 1885. A shrub, from one to two feet in height, with grass-like leaves nearly three inches in length; flowers large, rose-coloured, in short broad spikes. A very well-marked species, common throughout the Badghis at 3000 feet altitude.

Allied to *A. splendidum* and *A. latifolium*, which it resembles in its inflorescence and calyx.

STATICE SUFFRUTICOSA, Linn.; Boiss. Fl. Or. iv. p. 867.

Between Sher-baksh and Gaz-i-cha in the Harut basin; 65, November 10, 1884; Hari-rud valley: May 9, 1885; 780, August 18, 1885. In the shingly beds of dry water-courses; very characteristic and common.

STATICE PERFOLIATA, C. A. Mey.; Boiss. Fl. Or. iv. p. 866.

Hari-rud valley: 744, July 29, 1885. In saline, moist soil, associated with chenopodiaceous plants, ranging from a few inches in height to over four feet, with weak straggling branches often semi-scandent, springing from a large woody root-stock. In some localities it forms a thick scrub, but it is not generally common in the country.

STATICE LEPTOSTACHYA, Boiss. Fl. Or. iv. p. 872.

Hari-rud valley: 1076, May 12, 1885. In salt, sandy soil, especially where moisture has collected after a fall of rain, closely crowded together, forming a turf. Flowers snow-white.

Var. *scapis filiformibus*. Hari-rud valley: 331, April 27, 1885.

STATICE SPICATA, Willd.; Boiss. Fl. Or. iv. p. 871.

Hari-rud valley: 291, April 21, 1885; 341, April 29, 1885, May 13, 14, 1885. On sandy soil; only common in the northern part of the Hari-rud valley and Badghis district. A very conspicuous herb, with spikes of splendid rose-pink flowers.

Var. *foliis subintegris*.

Hari-rud valley: 1077, April 27, 1885. In saline sandy soil, associated with the type and *S. leptostachya*, forming together a sward. Flowers pure white.

PRIMULACEÆ.

PRIMULA, sp.

Badghis: 126, March 14, 15, 1885. In moist loamy soil on the low hills near Gulran, at an elevation above 2000 feet. Leaves from two to three inches in length; flower-buds carmine, developing magenta.

ANDROSACE MAXIMA, Linn.; Boiss. Fl. Or. iv. p. 18.

Hari-rud valley: 217, April 13, 1885; Badghis, May 1, 1885. In stony soil; very common. Flowers yellowish.

DIONYSIA TAPETODES, Bunge; Boiss. Fl. Or. iv. p. 21.

Khorasan: 634, June 16, 1885. Limestone cliffs, on a north-east exposure, at an altitude of above 5000 feet. Characteristic and clothing the rocks like a carpet of moss, but very difficult to collect.

GLAUX MARITIMA, Linn.; Boiss. Fl. Or. iv. p. 7.

Hari-rud valley: 1078, 1885. Common on banks of streams and in river-beds.

ANAGALLIS ARVENSIS, Linn.; Boiss. Fl. Or. iv. p. 6.

Hari-rud valley: 787, August 20, 1885. Occasional in loamy soil.

OLEACEÆ.

FRAXINUS OXYPHYLLA, Bieb.; var. β, Boiss. Fl. Or. iv. p. 40.

Khorasan: 1080, August 28, 1885. Native names: *Binaush, Benaush*. Cultivated in orchards and in the vicinity of houses; wood valued for all domestic purposes.

FRAXINUS, sp.

Hari-rud valley: 251, April 16, 1885; 1081, May 12, 1885. Native names: *Binaush, Benaush*. A cultivated tree, usually met with near shrines, and held sacred. The wood is valued for ploughs and farm-implements. I measured a tree in the village of Khusan which was 10 feet 6 inches in girth at six feet from the ground, though not 30 feet high, but divided into very large bulky branches.

APOCYNACEÆ.

Rhazya stricta, Decne.; Boiss. Fl. Or. iv. p. 46.

Northern Baluchistan: 20, Sept. 29, 30, 1884; 19, Sept. 29, 30, 1884. A shrub about three feet in height, very common in stony soil. The specimens numbered 20 have broader and more obtuse leaves than the type.

Nerium odorum, Sol.; Boiss. Fl. Or. iv. p. 47.

Northern Baluchistan: 1082, 1884. Native name *Jaur*. In Tamarisk-groves, near water; very common. This is extremely poisonous to camels.

Apocynum venetum, Linn.; Boiss. Fl. Or. iv. p. 48. (Plate XXXVII.)

Badghis: 115, March 5, 1885. Native names: *Dumb-i-roba*, *Kundar*, *Dumb-i-gosalla*. Common in beds of streams and in marshy localities at Gulran, at an altitude of 2000 feet. Stems about four feet high, springing from a creeping root-stock, and terminating in a panicle of flowers. The annual stems remain attached to the root-stocks, but by the action of the wind they are soon reduced to their fibrous element, and this is found in bunches, having the appearance of artificial preparation. My attention was attracted to them by the seed-vessels still persistent on the battered branches. The fibre is a most excellent one, and the wonder is, as the plant seems to be common from Eastern Europe to China, that it has not heretofore been employed in manufactures. The bark of the creeping root-stocks is employed in tanning the leather skins used as water-bottles.

Roots of this plant were sent to Saharunpore, whence we received flowering specimens for the Herbarium at Kew.

ASCLEPIADACEÆ.

Periploca aphylla, Decne.; Boiss. Fl. Or. ii. p. 50.

Northern Baluchistan: 47, October 6, 1884. Native names: *Um*, *Uma*; Punjabi *Batta*. Very common in the desert country amongst rocks.

Cynanchum acutum, Linn.; Boiss. Fl. Or. iv. p. 60.

Hari-rud valley: 423, May 10, 1885; 725, July 27, 1885, August 18, 20, 1885. Native name *Pech-kak*. In stream-beds, with Tamarisk; very common. The fruit of this species is not eaten.

Cynanchum, sp.

Helmand: October 1884. Native name *Pir-wathi*. A tall climber on the banks of the river amongst Tamarisk and *Populus euphratica*; in some localities covering the Poplar trees. It was cut down largely as fodder for the camels. The natives collected and ate the fruit, calling it *Shangar*.

The natives of the Hari-rud valley knew of its existence, but I never collected it there.

GENTIANACEÆ.

Erythræa babylonica, Griseb.—*Erythræa spicata*, Pers.; Boiss. Fl. Or. iv. p. 69.

Hari-rud valley: 760, August 3, 5, 20, 1885. Not uncommon on sandstone banks of streams.

Gentiana Olivieri, Griseb.; Boiss. Fl. Or. iv. p. 76.

Badghis: 360, May 1, 4, 1885. Native name *Gul-khalle.* In great luxuriance on the sandy downs of the Badghis, forming part of the sward along with several Carices. This is undoubtedly, as Boissier remarks, the Gentian of the hot country. It is in such profusion, that when in flower it gives a blue colouring to the downs.

BORAGINEÆ.

Heliotropium Eichwaldi, Steud.; Boiss. Fl. Or. iv. p. 131.

Hari-rud valley: 592, June 3, 1885; Khorasan, June 21, 1885. A common plant in stony places.

Heliotropium undulatum, Vahl; Boiss. Fl. Or. iv. p. 147.

Northern Baluchistan: 57, Oct. 9, 1884. A common plant in the desert.

Heliotropium chorassanicum, Bunge; Boiss. Fl. Or. iv. p. 129.

Hari-rud valley: 591, June 3, 6, 1885, July 27, 1885. Abundant on sandstone cliffs, though local. Flowers very numerous, large, pure white, and strongly scented.

Heliotropium cabulicum, Bunge; Boiss. Fl. Or. iv. p. 143.

Northern Baluchistan: 10, Sept. 29, 1884; Hari-rud valley: 1083, 411, May 9, 28, 1885.

Trichodesma molle, DC.; Boiss. Fl. Or. iv. p. 281.

Khorasan: 706, July 1, 1885. In the shingly soil of dry water-courses; extremely common in the Hari-rud valley, as well as in Khorasan. Plant spread flatly over the ground; flowers bright blue at first, but eventually bleached a dirty white by the sun.

Caccinia glauca, Savi; Boiss. Fl. Or. iv. p. 277.

Hari-rud valley: 172, April 6, 27, 1885; 618, June 6, 1885. Native name *Gao-zeban.* Common in the Badghis and Khorasan, as well as the Hari-rud valley. A very bright-flowered perennial, the annual shoots of which spring from a large underground root-stock. The root-stock is eaten and, as well as the flowers, employed in medicine by the natives. It is loaded with a most viscid juice, which seems to be palatable to the people of these parts; however, on my attempting to chew a portion of the stalk, my mouth felt as if it were going to be glued together.

Kuschakewiczia turkestanica, Regel & Smirnow, Descr. Pl. Nov. Turk. fasc. vi. p. 51, 1858.

Badghis: 132, March 18, 21, 1885, May 1, 21, 1885. Native name *Bajindak.* Very common on the downs of the Badghis. The cooked leaves are eaten as a pot-herb.

Solenanthus circinnatus, Ledeb.; Boiss. Fl. Or. iv. p. 270.

Paropamisus range: 398, May 5, 25, 1885. In the shade of large rocks and bushes, at an altitude of 5000 feet. When in flower it is a most elegant plant, growing to a height of from three to four feet.

Rindera cyclodonta, Bunge; Boiss. Fl. Or. iv. p. 275.

Badghis: 548, May 23, 1885. In sandy loamy soil near Kara-bagh.

Paracaryum rugulosum, Boiss. Fl. Or. iv. p. 256.

Khorasan, 692: June 18, 1885. In the bed of a dry water-course, at an altitude of 4000 feet.

Paracaryum, sp. "*Solenantho coronato*, Regel (Pl. Fedtsch. p. 59), arcte affinis, differt achæniorum disco minutissime papuloso medio minute aculeato."—*Regel in litt.*

Badghis: 382, May 2, 3, 19, 20, 1885; Paropamisus range: May 25, 1885. On the low hills and ridges of the Badghis up to an altitude of 5000 feet; on the Paropamisus range, extremely common. Flowers deep purple, fruit stellate.

Paracaryum, sp.

Hari-rud valley: 425, May 10, 1885. In low sandstone hills; common.

Echinospermum brachysepalum, Claus, Localfl. der Wolgageg. in Beitr. zur Pflanzenkunde des russ. R. viii. pp. 65, 240.

Hari-rud valley: 1084, April 14, 21, 1885. Common in the shade of bushes.

Echinospermum sinaicum, A. DC.; Boiss. Fl. Or. iv. p. 251.

Hari-rud valley: 241, April 15, 17, 1885.

Echinospermum oligacanthum, Boiss. Fl. Or. iv. p. 248 (e descriptione).

Hari-rud valley: 1085, May 9, 1885.

Echinospermum minimum, Lehm.; Hook. fil. Fl. British India, iv. p. 162.

Hari-rud valley: 180, April 6, 11, 17, 1885. A common plant.

Echinospermum lævigatum, Kar et Kir.; Boiss. Fl. Or. iv. p. 248.

Hari-rud valley: 166, 263, April 6, 17, 21, 1885; Paropamisus: May 25, 1885. Very common. One of the few plants of the order which are quite glabrous.

Echinospermum sessiliflorum, Boiss. Fl. Or. iv. p. 253.

Hari-rud valley: 1086, May 9, 1885.

Echinospermum barbatum, Bieb.; Boiss. Fl. Or. iv. p. 250.

Paropamisus range: 1087, May 26, 1885. At an altitude of 5000 feet.

Echinospermum Lappula, Lehm.; Boiss. Fl. Or. iv. p. 249.

Badghis: 388, May 3, 1885.

Echinospermum, sp.—Aff. *E. microcarpo*, Ledeb.

Khorasan: 681, June 18, 1885. On damp rocks, at an altitude of above 3000 feet.

Echinospermum, sp.

Hari-rud valley: 169, April 6, 7, 16, 17, 1885. In cultivated land, common.

Rochelia stylaris, Boiss. Fl. Or. iv. p. 245.

Hari-rud valley: 1088, May 10, 1885.

ASPERUGO PROCUMBENS, Linn.; Boiss. Fl. Or. iv. p. 275.

Hari-rud valley: 190, April 7, 13, 1885; Paropamisus, May 26, 1885. Very common, in good soil, and in the shade of bushes, &c.

ANCHUSA ITALICA, Retz.; Boiss. Fl. Or. iv. p. 154.

Hari-rud valley: 314, April 25, 1885, May 12, 1885. In cultivated land, common; a very showy plant in corn-fields.

LYCOPSIS ARVENSIS, Linn.—*Anchusa arvensis*, Bieb.; Boiss. Fl. Or. iv. p. 160.

Hari-rud valley: 588, June 3, 1885. In cultivated soil, common.

NONNEA PICTA, Fisch. et Mey.; Boiss. Fl. Or. iv. p. 166.

Hari-rud valley: 168, April 6, 18, 1885. Very common.

My Afghanistan specimens, distributed under the numbers 483 and 230, of 1879, are of this species and not *N. nigricans*, as originally named.

MYOSOTIS STRICTA, Link; Boiss. Fl. Or. iv. p. 239.

Badghis: 375, May 1, 1885. In the shade of rocks, growing in dense patches.

LITHOSPERMUM TENUIFLORUM, Linn. fil.; Boiss. Fl. Or. iv. p. 217.

Hari-rud valley: 234, April 13, 1885. A common plant in cultivated fields.

LITHOSPERMUM OFFICINALE, Linn.; Boiss. Fl. Or. iv. p. 218.

Khorasan: 676, June 18, 1885. In the shade of bushes near water, at an altitude of 5000 feet; not common.

ARNEBIA LINEARIFOLIA, DC.; Boiss. Fl. Or. iv. p. 214.

Hari-rud valley: 184, 206, 263, during April 1885, June 5, 1885. Excessively common in the shade, in gravelly soil. The flowers usually straw-coloured, but frequently having a dot of deep purple on each lobe of the corolla resembling the flowers of *Arnebia Griffithii* in miniature.

ONOSMA ECHIOIDES, Linn.; Boiss. Fl. Or. iv. p. 181.

Badghis: 550, May 23, 1885; Khorasan, June 16, 1885. Not uncommon, in clefts of rocks, at an altitude of 3000 feet and upwards. Flowers of a brilliant orange-yellow.

CONVOLVULACEÆ.

CONVOLVULUS FRUTICOSUS, Pall.; Boiss. Fl. Or. iv. p. 87.

Hari-rud valley: 401, May 7, 1885; 418, May 10, 1885; 763, August 4, 1885. A low, woody shrub, armed with numerous sharp spines; very characteristic of the arid country.

CONVOLVULUS LINEATUS, Linn.; Boiss. Fl. Or. iv. p. 97.

Badghis: 540, May 22, 1885. Local, on bare stony ground.

CONVOLVULUS ERINACEUS, Ledeb.; Boiss. Fl. Or. iv. p. 87.

Northern Baluchistan: 26, Sept. 29, 1884; Hari-rud valley: 606, June 5, 1885; 731, July 27, 1885. A very characteristic shrub, from 2 to 3 feet in height, growing in the form of a large ball, and very much resembling in general habit, and from similar localities as, *Lactuca orientalis*. The flowers are pure white, open at sunrise, and closing at once under the direct rays of the sun.

Convolvulus subhirsutus, Regel & Schmalh. Descrip. Plant. Nov. Turkestan. fasc. vii. 1879, p. 53.

Badghis: 533, May 21, 1885. A conspicuous shrub, throwing up dense clusters of annual stems three to four feet in height.

Convolvulus arvensis, Linn.; Boiss. Fl. Or. iv. p. 108.

Hari-rud valley: 436, May 11, 1885, June 3, 1885; Badghis: May 16, 1885.

Convolvulus pilosellæfolius, Desr.; Boiss. Fl. Or. iv. p. 103.

Hari-rud valley: 619, June 6, 1885; Khorasan: June 12, 21, 28, 1885. A very common plant in the vicinity of cultivation.

Cressa cretica, Linn.; Boiss. Fl. Or. iv. p. 114.

Helmand valley: 76, Oct. 23, 1884; Hari-rud valley: 614, June 6, 1885; 785, August 20, 1885. Extremely common, especially on clay soil.

Cuscuta, sp.

Hari-rud valley: 430, May 10, 1885; Badghis: May 19, 1885. A common parasite.

Cuscuta, sp.

Hari-rud valley: 1089, May 28, 1885. Common on low bushes.

SOLANACEÆ.

Solanum nigrum, Linn.; Boiss. Fl. Or. iv. p. 284.

Helmand valley: October 28, 1884; Hari-rud valley: 727, July 27, 1885; Khorasan. A very common plant, the leaves of which are cooked as a pot-herb.

Lycium barbarum, Linn.; Boiss. Fl. Or. iv. p. 289.

Northern Baluchistan: 37, October 4, 1884, October 11, 1884; Hari-rud valley: April 18, 1885, June 5, 1885. Very characteristic of the Hari-rud river, where it was one of the first shrubs to throw out its early, bright, rice-green foliage, which was noticeable from a great distance. It is sometimes as much as 12 feet in height, with long, pendulous branches, like those of a Bramble. The fruit is bright red, and dries on the shrub. The natives in Baluchistan, owing to the bright colour of the fruit, call this, as well as *Stocksia*, *Koh-tor*. It was supposed that we lost so many camels at Omar-sha in consequence of their eating this shrub when in fruit.

Lycium ruthenicum, Murr.; Boiss. Fl. Or. iv. p. 290.

Hari-rud valley: 736, July 27, 30, 1885. A common shrub on the outskirts of villages and near old buildings. Fruit the shape and size of a large pea, deep purple when ripe.

DATURA STRAMONIUM, Linn.; Boiss. Fl. Or. iv. p. 292.

Hari-rud valley; Nov. 20, 1884. Native name *Katchola* or *Datura*. This plant was common in the neighbourhood of the fort at Khusan, but I did not see it anywhere else. I doubt its being indigenous, although propagating itself freely.

HYOSCYAMUS PUSILLUS, Linn.; Boiss. Fl. Or. iv. p. 294.

Hari-rud valley: 265, April 17, 19, 1885. Very common everywhere in good soil.

HYOSCYAMUS RETICULATUS, Linn.; Boiss. Fl. Or. iv. p. 295.

Badghis: 545, May 22, 1885; Paropamisus range: 567, May 22, 1885; Khorasan: June 17, 1885. Generally common, at an altitude above 2500 feet. It is greedily eaten by goats and sheep.

HYOSCYAMUS SENECIONIS, Willd., var.? MULTIFIDUS, Aitch. et Hemsl. (Plate XXXVIII.)

Ab typo et var. β. differt foliis tripinnatisectis, calycis lobis pinnatifidis.

Khorasan: 635, June 16, 1885. Only obtained in one locality, at an altitude above 5000 feet, on limestone formation, on the banks of a stream, in a deep gorge of the hills, to the south of Bezd. In general habit it strongly resembles cucurbitaceous plants, creeping over gravel and boulders.

We were at first disposed to regard this as a distinct species, and we are still in doubt whether it should rank as one, though it hardly differs more from *H. Senecionis*, *β. bipinnatisectus*, Boiss., than that does from typical *H. Senecionis*.

NICOTIANA TABACUM, Linn.; Hook. fil. Fl. British India, iv. p. 245.

Khorasan: 797, August 23, 1885. Native names: *Tumaku*, *Tambaku*. Cultivated largely both in Afghanistan and Khorasan.

NICOTIANA RUSTICA, Linn.; Hook. fil. Fl. British India, iv. p. 245.

Khorasan: 798, August 23, 1885. Native names: *Turkamani-tambaku*. Cultivated equally with *N. Tabacum*. From the native name this is supposed to have been an introduction from the Turkiman country. There is a considerable local trade in tobacco, but whether it is exported I was unable to find out.

SCROPHULARIACEÆ.

VERBASCUM, sp.

Badghis: 531, May 21, 1885; Khorasan: June 16, 1885. Common, at an altitude above 3000 feet, in the Badghis, and in the hills to the south of Bezd. A very handsome plant, from 3 to 4 feet in height; flowers large, bright yellow, with bright orange filaments.

CELSIA HETEROPHYLLA, Desf.; Boiss. Fl. Or. iv. p. 359.

Hari-rud valley: 1090, 1885. In gravelly soil, near running water at Tirphul.

LINARIA ELATINE, Mill.; Boiss. Fl. Or. iv. p. 367.

Khorasan: 810, August 28, 1885. Only one specimen obtained, in the shadow of a large rock, at Rui-khauf.

LINARIA PERSICA, Chav.; Boiss. Fl. Or. iv. p. 384.

Hari-rud valley: 328, April 27, 1885; May 13, 1885. Common, in the shade of shrubs, growing in good soil. Flowers almost pure white, with occasionally a slight tinge of pink.

SCROPHULARIA ALATA, Gilib.; Boiss. Fl. Or. iv. p. 399.

Khorasan: 685, June 18, 1885. In moist meadow land, at an altitude of 5000 feet. A very handsome plant, growing three feet high, and much resembling in general character and habit *S. aquatica*, Linn.

SCROPHULARIA CABULICA, Benth., var. *ramulis gracilibus*; Boiss. Fl. Or. iv. p. 420.

Badghis: 491, May 17, 23, 1885; Khorasan: June 14, 1885. Common in stony soil over the country generally.

SCROPHULARIA, sp.

Badghis: 513, May 19, 1885. In soft clayey soil, on the ridges of low hills, at an altitude of 3000 feet, common.

DODARTIA ORIENTALIS, Linn.; Boiss. Fl. Or. iv. p. 424.

Hari-rud valley: 1091, July 27, 1885. On islands in the river, and in land that is occasionally overflown by the river; common. Flowers purple.

VERONICA BILOBA, Linn.; Boiss. Fl. Or. iv. p. 464.

Hari-rud valley: 147, April 2, 6, 7, 13, 15, 16, 1885; Badghis: 380, May 1, 2, 1885. Everywhere common in the shade of other plants.

VERONICA ANAGALLIS, Linn.; Boiss. Fl. Or. iv. p. 437.

Badghis: 494, May 18, 1885; Hari-rud valley: August 4, 1885. In running water.

Var. *caulibus foliisque glanduloso-pubescentibus*.

Paropamisus range: 562, May 25, 1885. At an altitude above 5000 feet; in running water.

PEDICULARIS, sp.

Khorasan: 679, June 18, 1885. On hill-sides, at an altitude above 5000 feet, in great quantity; but not a good specimen could be obtained, owing to the pasturage having been closely grazed by sheep and goats.

OROBANCHACEÆ.

CISTANCHE RIDGEWAYANA, Aitch. et Hemsl., n. sp. (Plate XXXIX.) *Herba* pedalis ad sesquipedalem. *Caulis* simplex, sursum crassior, densissime squamiferus, squamis scariosis obtusis. *Flores* sessiles, ebracteolati, glabri, numerosissimi, dense spicati; bracteæ oblongæ, obtusissimæ, margine albo-lanatæ, calycem excedentes; calyx fere regulariter 5-lobatus, lobis latis rotundatis; corolla cylindrica, recta, regulariter 5-lobata, lobis brevibus rotundatis; stamina inclusa, antheris filamentisque basi barbatis; ovarium glabrum, placentis 6 lamelliformibus; stylus stamina æquans vel paullo excedens, stigmate maximo capitato.

Hari-rud valley: 1093 (in part), April 23, 1885; May 12, 1885. On the banks of the

Hari-rud river, parasitical on Tamarisk. Stems from one to two feet in height, covered with numerous brown, leathery scales. Flowers yellowish white, tipped with reddish chocolate, or maroon, each flower being subtended by a large bract, which is fringed with a line of short white hairs. An extremely handsome parasite, differing from *C. Salsæ* in being wholly glabrous except the margins of the bracts.

CISTANCHE LAXIFLORA, Aitch. et Hemsl., n. sp. (Plate XL.) *Herba* glabra, circiter sesquipedalis, caule simplice pauci-squamifera, squamis pollicaribus. *Flores* glabri, 8–10, laxe racemosi, brevissime pedunculati, 1-bracteati, 2-bracteolati; bractea ovato-oblonga, obtusa, calyce paullo longiore, bracteolis angustioribus brevioribus; calyx fere regularis, 5-lobatus, lobis rotundatis integris vel interdum 3-dentatis; corollæ curvatæ limbus ampliatus, lobis latis rotundatis; stamina vix exserta, filamentis basi hirsutis, antheris densissime barbatis; ovarium glabrum, placentis 4, peltatis; stylus curvatus, breviter exsertus, stigmate capitato.

Hari-rud valley: 1093 (in part), April and May 1885. This species, which is allied to the European *C. lutea*, was mixed with *C. Ridgewayana* and distributed with it under the same number.

OROBANCHE ÆGYPTIACA, Boiss.—*Phelipæa ægyptiaca*, Walp.; Boiss. Fl. Or. iv. p. 499.

Khorasan: 793, August 23, 1885. A noxious weed in tobacco- and melon-fields, on both of which plants this species is parasitical. It grows in such quantity that, when in full blossom, it gives the field a general blue colour.

OROBANCHE STOCKSII, Boiss. Fl. Or. iv. p. 505.

Badghis: 482, May 17, 1885; Hari-rud valley: May 28, 1885. Very common, and parasitical on a species of *Cousinia*. Flowers large and showy, bell-shaped, and pale rose-pink.

In Northern Baluchistan I frequently met with the dried remains of a similar large *Orobanche* growing on Tamarisk, which the natives call *Labbu*, and which, in early summer, they collect to feed their camels.

OROBANCHE, sp.

Hari-rud valley: 333, April 27 and May 10, 1885. Parasitical on a Chenopodiaceous plant; flowers brown. Badghis: May 4, 1885. Flowers strawberry- and cream-colour. Native name *Pir-ingir*. Stems eaten as a vegetable.

OROBANCHE, sp.

Hari-rud valley: 1092, May 13, 14, 1885. Parasitical on *Cousinia*; flowers white edged with blue.

OROBANCHE, sp.

Hari-rud valley: 1094 (in part), June 4, 1885; May 28, 1885. Parasitical on *Artemisia*. About eight inches in height; flowers tipped with dark blue, gradually fading downwards to the lower part of the corolla, where it is pure white.

OROBANCHE, sp.

Hari-rud valley: 1094 (in part), May 4, 1885.

Orobanche, sp.

Hari-rud valley: 450, May 12, 1885. Parasitical on *Cousinia alata* and on a *Labiata*. Flowers almost blue.

PEDALINEÆ.

Sesamum indicum, Linn.; Boiss. Fl. Or. iv. p. 81.

Khorasan: 809, August 27, 1885. Native name *Kunjit*. Cultivated extensively for the oil obtained from its seed. Dependent on irrigation and usually associated with water-melons. Flowers pure white.

VERBENACEÆ.

Vitex Agnus-castus, Linn.; Boiss. Fl. Or. iv. p. 535.

Northern Baluchistan, between Kushk-rud and Kin: 1099, Nov. 3, 1884. A shrub, from seven to nine feet in height, in water-courses, which, although apparently dry, looked as if water were still not far from the surface.

LABIATÆ.

Ocimum Basilicum, Linn.; Boiss. Fl. Or. iv. p. 539.

Khorasan: 811, August 28, 1885. A common weed in orchards, and noted at the time as probably an escape. Bunge collected it near Meshed, where Boissier regarded it as a colonist.

Mentha sylvestris, Linn.; Boiss. Fl. Or. iv. p. 543, var. *elata*.

Baluchistan: 60, Oct. 11, 1884. In beds of streams amongst tamarisk shrubs; growing nearly seven feet high and forming large clumps.

Another variety was collected in the Hari-rud valley: 773, August 5, 1885.

On the edges of irrigation-channels, and sides of running streams, common.

Satureia hortensis, Linn.; Boiss. Fl. Or. iv. p. 562.

Khorasan: 813, August 28, 1885. A strongly aromatic herb, from one to two feet in height, growing in the vicinity of water, and forming a dense scrub.

Perowskia abrotanoides, Kar.; Boiss. Fl. Or. iv. p. 589.

Baluchistan: 4, Sept. 25, 1884; Khorasan: 806, August 27, 1885. In extremely hot localities, on limestone formation, boulders, and gravel, forming large densely branched bushes four feet in height, and some six feet across.

Perowskia, sp.

Baluchistan: 22, Sept. 30, 1884.

Salvia spinosa, Linn.; Boiss. Fl. Or. iv. p. 613.

Badghis: 505, May 18, 1885; 517, May 19, 20, 22, 1885. On the rolling downs of the Badghis; common. The plant is covered with large pure white flowers. The foliage is deliciously scented.

SALVIA MACROSIPHON, Boiss. Fl. Or. iv. p. 615.

Hari-rud valley: 594, June 3, 1885; Khorasan: 636, June 16, 1885. A common plant in stony ground.

SALVIA CERATOPHYLLA, Linn.; Boiss. Fl. Or. iv. p. 617.

Badghis: 530, May 21, 1885. In the low sandstone hills near Gulran, at an altitude of about 3000 feet; very conspicuous, owing to its peculiar soft velvety radical leaves, which are so very different from the rest of the plant. It is said to be employed in medicine.

ZIZIPHORA TENUIOR, Linn.; Boiss. Fl. Or. iv. p. 587.

Hari-rud valley: 329, April 27, 1885, May 10, 1885; Khorasan, July 1, 1885. Native name *Kakuti*. Common in gravelly soil; employed in medicine.

ZIZIPHORA CANESCENS, Benth.—*Z. clinopodioides*, Bieb., var. β. *canescens*, Boiss. Fl. Or. iv. p. 585.

Khorasan: 639, June 16, 1885. In stony ground, at an altitude above 4000 feet; a small close bush, a foot in height.

NEPETA MEYERI, Benth.—*Nepeta micrantha*, Bunge; Boiss. Fl. Or. iv. p. 664.

Badghis: 467, 1095, May 16, 1885. Common in shady places, in stony soil.

NEPETA PUNGENS, Benth.; Boiss. Fl. Or. iv. p. 666.

Badghis: 472, May 16, 1885.

NEPETA SATUREIOIDES, Boiss. Fl. Or. iv. p. 667.

Hari-rud valley: 413, May 9, 1885; Khorasan: July 1, 1885. In the dried-up gravelly beds of water-courses. Flowers lavender-blue.

NEPETA PERSICA, Boiss. Fl. Or. iv. p. 657.

Khorasan: 642, June 16, 1885. In the débris at the foot of limestone cliffs, at an altitude of 5000 feet; common.

NEPETA (§ CATARIA, Benth., § MICRANTHÆ, Boiss.) SEWERZOWII, Regel. (Plate XLI.)

Annua, erecta, parce puberula, caule, ut videtur, semper simplici, 6–18 poll. alto, graciliusculo. *Folia* graciliter petiolata vel suprema subsessilia, cordato-rotundata vel oblonga, grosse crenata (specimina Stocksiana foliis angustioribus breviter petiolatis). *Flores* parvi, pauci in cymas laxas graciliter pedunculatas foliis breviores dispositi; calyx scabridus, conspicue 20-nervis, subæqualiter 5-dentatus, dentibus fere aculeatis, fructifer rigidus, basi valde ventricosus; corollæ hirtæ tubo incluso. *Nuculæ* rotundatæ, tuberculatæ vel verrucosæ, areola magna laterali.

Badghis: 373, May 1, 1885. In shady places, very common.

Next to *N. micrantha*, from which it is readily distinguished by its fewer-flowered looser cymes, and nearly equally toothed calyx, which is very much obliquely inflated in the fruiting stage. The same species was collected by Stocks in Baluchistan, and we at first took it for an undescribed one, as there was no specimen at Kew of *N. Sewerzowii*; but we have since received Dr. Regel's determination.

NEPETA MICRANTHA, Bunge; Boiss. Fl. Or. iv. p. 664.

Badghis: 467, May 16, 1885. In stony places, common.

LALLEMANTIA ROYLEANA, Benth.; Boiss. Fl. Or. iv. p. 674.

Hari-rud valley: 200, April 10, 15, 17, 26, 27, 1885. Very common, in good soil.

HYMENOCRATER ELEGANS, Bunge, var.; Boiss. Fl. Or. iv. p. 678.

Khorasan: 643, June 16, 1885. In limestone rubbish at the base of cliffs, at an altitude above 4000 feet. A woody herb, one to two feet high; flowers mauve, the enlarged calyx is of a lovely rose-colour. Owing to the brilliant colouring of the calyx, this plant would be well worth cultivation.

SCUTELLARIA MULTICAULIS, Boiss.; Fl. Or. iv. p. 685, var.

Badghis: 474, May 16, 1885. A common undershrub, in rocks, from a foot to eighteen inches in height; flowers yellow, lower lip deep purple.

MARRUBIUM VULGARE, Linn.; Boiss. Fl. Or. iv. p. 703.

Khorasan: 1096, June 16, 1885. Common at an elevation of 4000 feet.

CHAMÆSPHACOS PERSICUS, Aitch. et Hemsl. (Plate XLII. figs. 1–6.)—*Tapeinanthus persicus*, Boiss. Fl. Or. iv. p. 679.

Hari-rud valley: 207, April 11, 12, 15, 21, 27, 1885. Extremely common in shady places, under shrubs. Flowers pure white or rose-pink.

CHAMÆSPHACOS BRAHUICUS, Aitch. et Hemsl.—*Tapeinanthus brahuicus*, Boiss. Fl. Or. iv. p. 680.

Khorasan: 626, June 14, 1885. In stony ground; flowers rose-coloured.

CHAMÆSPHACOS AFGHANICUS, Aitch. et Hemsl., n. sp. (Plate XLII. figs. 7–11.) *Herba* annua, 2–4 poll. alta, pauciramosa, primum parce villosula. *Folia* crassiuscula, obovato-spathulata, 1–1½ poll. longa, in petiolum plus minusve distincte attenuata, integra vel obscure paucidentata, obtusa vel subacuta. *Flores* purpurei, villosuli, axillares, solitarii, breviter pedunculati; calycis faux villosa, dentibus latis subito acuminatis; corollæ tubus calyce inclusus; stamina 4. *Nuculæ* non visæ.

Hari-rud valley: 183, April 7, 1885. In damp soil, near the roots of large bushes, common. Flowers rose-coloured.

This is nearest to the smaller, much more branched, very villous *C. brahuicus*.

CHAMÆSPHACOS ILICIFOLIUS, Schrenk; Boiss. Fl. Or. iv. p. 680. (Plate XLII. figs. 12–18.)

Hari-rud valley: 299, April 21, 1885; 617, June 6, 1885. In sandy soil, on the banks of the Hari-rud river.

STACHYS TRINERVIS, Aitch. et Hemsl., n. sp. (Plate XLIII.) *Frutex* ramosus, 3–4-pedalis, undique plus minusve stellato-pubescens, ramulis floriferis dense cano-tomentosis. *Folia* sessilia, semiamplexicaulia, subconnata, papyracea, ovato-lanceolata, lineari-lanceolata, vel oblonga, circiter pollicaria, obtusa vel subacuta, subtrinervia. *Flores* albi, in axillis foliorum solitarii, breviter pedunculati, 8–9 lineas longi; calyx 10-nervosus, fere æqualiter 5-lobatus, regularis, lobis latis 3-nervosis vix acutis, fructifer glabrescens, induratus, campanulatus; corollæ parcissime puberulæ tubus breviter exsertus; labium superius brevius, ovale, bidentatum, striatum, divaricatum; labium inferius trilobatum, lobis lateralibus brevissimis rotundatis; stamina 4, breviter exserta, fere æquilonga, filamentis planis papillosis simul puberulis; stylus inclusus. *Nuculæ* glabræ, oblongæ, anguste circumalatæ.

Hari-rud valley: 157, April 2, 3, 7, 29, 1885; May 10, 1885. Native name *Kalpura*. A characteristic shrub of the gravel plains of the Hari-rud valley; from three to four feet in height; much browsed by sheep and goats. Flowers pure white.

Near *S. fruticulosa*, from which it is readily distinguished by its stellate indumentum, acute calyx-lobes, &c. Perhaps this and its immediate allies should form an independent genus.

LAMIUM AMPLEXICAULE, Linn.; Boiss. Fl. Or. iv. p. 760.

Hari-rud valley: 230, April 13, 1885. In cultivated soil, common.

PHLOMIS HERBA-VENTI, Linn., var. *floribus albidis*, Boiss. Fl. Or. iv. p. 791.

Khorasan: 656, June 16, 17, 1885. In stony places, at an altitude of 4000 feet. A very conspicuous herb, growing in dense clumps, from a foot to two feet in height. Flowers of this variety a dirty white.

EREMOSTACHYS LABIOSA, Bunge, var. *a*. CANESCENS, Regel, Monogr. Gen. Erem. p. 8.—*E. diversifolia*, Regel, Descr. Pl. Nov. Turkest. 1879, fasc. vii. p. 94; *E. napuligera*, Franchet, in Ann. Sc. Nat. 6^{me} série, xviii. p. 237, t. 17.

Badghis: 355, May 1, 18, 1885. Native names: Turki, *Aggar-maggar*; Pers., *Khoarbarrar*. An extremely common plant in the loamy soil of the downs of the Badghis. The fibrous roots expand into tubers, due, I believe, to an insect. The tubers are largely collected and employed chiefly by the Turkomans in washing their bodies with, as a rubefacient. Flowers white, with a yellow lower lip. A very showy and handsome plant when in flower.

EREMOSTACHYS PERSIMILIS, Aitch. et Hemsl., n. sp. "A specie affini *E. glabra* differt, bracteis calycem æquantibus vel superantibus, calycis vix hirsuti apicem versus paullo dilatata dentes in spinam elongatam excurrentes."—*Regel in litt.*

Herba perennis, 1–2 ped. alta, glabra vel glabrescens, caule sæpius simplici. *Folia* papyracea, glabra, subnitida, petiolata (petiolo radicalium laminam fere æquante), ovato-oblonga, maxima, absque petiolo, 9 poll. longa, breviter pinnatifida, simul crenata vel duplicato grosse crenata, costa albida atque venis reticulatis subtus valde elevatis, petiolo basi sericeo-lanato; folia floralia sessilia, semiamplexicaulia, flores excedentia. *Flores* lutei, in axillis 3 subsessiles, bracteolis lineari-subulatis, calycem superantibus; calyx pilosulus vel glabrescens, apice leviter ampliatus, dentibus spiniformibus circiter 3 lineas longis; corollæ extus parcissime hirsutæ tubus breviter exsertus; labium superius brevius, galeatum, intus sat barbatum; labium inferius late trilobatum; antheræ glabræ. *Nuculæ* brunneæ, lateribus glabræ, apice peniculoideæ.

Badghis: 464, May 14, 15, 19, 1885. On the ridges of low sandstone hills; not uncommon. An exceedingly handsome plant, about two feet in height; the spike of large bright yellow flowers being almost a foot long.

EREMOSTACHYS REGELIANA, Aitch. et Hemsl., n. sp. "Radice tuberosa *E. labiosæ* affinis, habitu *E. laciniatæ*, differt autem verticillastris bifloris, bracteolis calycem apicem versus paullo dilatatim subæquantibus, radice tuberoso, etc."—*Regel in litt.*

Herba perennis, plus minus, præcipue quoad calyces, arachnoideo-villosa, circiter pedalis, caule simplice vel ramoso. *Folia* radicalia petiolata, bipinnatifida, ad 6 poll. longa, petiolis basi sericeo-lanatis; folia caulina pauca, pinnatifida, floralia sursum gradatim minora, simul minus dissecta, superna bracteiformia, integra, floribus breviora. *Flores* albi, in axillis solitarii, subsessiles, bracteolis subulatis; calycis dentes breves, spiniformes, ore ampliato, intus valide elevato-nervoso; corollæ tubus inclusus, labio superiore galeato intus longe albo-barbato, extus plus minus hirsuto, labio inferiore late trilobato; antheræ longe exsertæ, glabræ. *Nuculæ* atræ, lateribus glabræ, vertice peniculoideæ.

Hari-rud valley: 290, April 21, 1885. Common in gravelly soil. Flowers pure white; roots covered with large tubercles.

EREMOSTACHYS, sp.

Hari-rud valley: 1097, May 10, 1885. An extremely woolly plant, with very large white flowers.

EREMOSTACHYS, sp.

Badghis: 1098, April 29, 1885. A species with glaucous leaves, &c., but we have too little material to identify it.

TEUCRIUM POLIUM, Linn.; Boiss. Fl. Or. iv. p. 821.

Khorasan: 791, August 23, 24, 1885. In broken limestone; common.

TEUCRIUM SERRATUM, Benth.; Boiss. Fl. Or. iv. p. 813.

Do-shakh Mt.: 771, August 5, 1885. The few specimens of this plant that we possess I collected with my own hands. It was strongly scented like *Asafœtida*. The moment I took portions for specimens, a very strong odour was perceived, and I looked carefully to see if it was not due to my having come in contact with *Asafœtida* itself; but this was not the case, and I found that on crushing its leaves the odour was at once more strongly perceptible.

AJUGA CHAMÆCISTUS, Ging., var. EUPHRASIOIDES, Boiss. Fl. Or. iv. p. 801.

Badghis: 549, May 23, 1885. In rocky ground, not uncommon. A very handsome species, having the lower lip of the corolla of a rose-pink, and rest of flower greenish, with dark veins of red. Well worth the attention of cultivators for the rock-garden.

PLANTAGINEÆ.

Plantago lanceolata, Linn. (varietates); Boiss. Fl. Or. iv. p. 881.

Hari-rud valley: 313, April 25, and 770, August 5, 1885; Badghis: May 14, 1885; Khorasan: 620, June 14, 1885. Common in cultivated soil and on the sides of irrigation-channels.

Plantago major, Linn.; Boiss. Fl. Or. iv. p. 878.

Khorasan: 701, June 28, 1885. In cultivated land; common.

Plantago maritima, Linn.; Boiss. Fl. Or. iv. p. 889.

Hari-rud valley: 758, August 1, 1885. The encampment about three miles from Zindijan was on a dense turf of this plant, where it alone appeared to be able to struggle against the deposit of sand wafted by the wind from the low hills across the river.

Plantago lachnantha, Bunge; Boiss. Fl. Or. iv. p. 887.

Hari-rud valley: 275, April 19, 26, 1885, May 13, 1885. In sandy and clayey soil; very common.

ILLECEBRACEÆ.

Paronychia kurdica, Boiss. Fl. Or. i. p. 744.

Khorasan: 641, June 16, 1885. On the shady side of limestone rocks, at an elevation of 5000 feet.

AMARANTACEÆ.

Amarantus paniculatus, Linn.; Boiss. Fl. Or. iv. p. 989.

Khorasan: 1101, August 1885. Native name *Taj-Karrus*. A cultivated plant in melon-fields, both red and yellow-flowered varieties. There seems to be some superstition regarding the growing one or two of these in a field.

Amarantus Blitum, Linn.—*Amarantus sylvestris*, Desf.; Boiss. Fl. Or. iv. p. 990.

Khorasan: 797, August 23, 1885. Common in moist soil.

CHENOPODIACEÆ.

Chenopodium Botrys, Linn.; Boiss. Fl. Or. iv. p. 903.

Mount Do-shakh: 764, August 4, 1885. In gravelly beds of water-courses. A large coarse herb, very strongly scented; collected and eaten as a pot-herb.

Chenopodium Blitum, Hook. fil. Flora British India, v. p. 5.—*Blitum virgatum*, Linn.; Boiss. Fl. Or. iv. p. 905.

Khorasan: 652, June 16, 1885. Near moisture, in a limestone gorge, at an altitude above 5000 feet.

SPINACEA OLERACEA, Linn.; DC. Prodr. xiii. 2, p. 118.—*Spinacia tetrandra*, Stev.; Boiss. Fl. Or. iv. p. 906.

Badghis: 501, May 18, 1885. Profuse in the vicinity of Simkoh, collected as a pot-herb by the natives, and called *Spinaj*. I have no doubt that Mr. DeCandolle is quite correct in assuming *Spinacia tetrandra* to be the wild form of *S. oleracea*, the native country of which is unknown.

ATRIPLEX DIMORPHOSTEGIUM, Kar. et Kir., var.; Boiss. Fl. Or. iv. p. 909.

Khorasan: 696, June 21, 1885. The fruit in our specimens is distinctly sagittiform.

ATRIPLEX ROSEUM, Linn.; Boiss. Fl. Or. iv. p. 911.

Hari-rud valley: 781, August 18, 1885. In the vicinity of old buildings and villages. A very variable plant, from a few inches to three feet in height.

ATRIPLEX MONETA, Bunge; Boiss. Fl. Or. iv. p. 912. (Plate XLIV.)

Hari-rud valley: 449, May 12, 1885; July 28, 1885. A very conspicuous plant, from its bright green foliage. Occurring in abundance at the base of the sand cliffs overhanging the river near Kumani-bhest and also at Kalcha. It is a most excellent spinach.

We have identified this remarkable species from the description. Griffith's number 1750, cited by Bunge, is not represented in the Kew Herbarium; but two species of *Atriplex* were attached to the same sheet of Bentham's set under the number 1751, cited by Moquin (DC. Prodr. xiii. 2, p. 102), as the type of his *A. Griffithii*. It would appear, therefore, that the label of 1750 had been lost, and the plant taken to be the same as 1751. There is also a specimen of *A. Moneta* in the Hookerian set of Griffith's plants, but without an original label. Our specimens are much more luxuriant than Griffith's, and, at first sight, would be taken for a different species.

ATRIPLEX FLABELLUM, Bunge; Boiss. Fl. Or. iv. p. 912.

Badghis: 362, May 1, 1885; 469, May 16, 1885. Amongst Tamarisk scrub, growing 3 feet high, and occurring in great abundance; eaten greedily by camels.

EUROTIA CERATOIDES, C. A. Mey.; Boiss. Fl. Or. iv. p. 917.

Hari-rud valley: 300, April 21, 1885, May 9, 1885, June 5, 1885. A very characteristic shrub of the gravel and boulder country, all over the plains. About 3 feet in height and often forming a bush 9 feet in circumference. The long silky hairs of the fruiting bracts are naturally pure white, but in the herbarium become a red-brown, like those of several *Convolvuli* and some other genera.

CERATOCARPUS ARENARIUS, Linn.; Boiss. Fl. Or. iv. p. 919.

Hari-rud valley: 597, June 4, 1885. Covering the ground in the gravelly plains near Shekewan.

CORISPERMUM LEHMANNIANUM, Bunge; Boiss. Fl. Or. iv. p. 930.

Hari-rud valley: 616, June 6, 1885. In sand, on the banks of the river; not uncommon.

Agriophyllum latifolium, Fisch. et Mey.; Boiss. Fl. Or. iv. p. 929.

Northern Baluchistan: 8, Sept. 29, 30, 1884. Native name *Chirko*. This plant grows in almost pure sand, on the sand-hills of the Baluchistan desert; and notwithstanding its extremely long roots, the wind, owing to the quantity of its foliage, lifts it out of the sand, and it is to be seen rolling in collected masses all over the flat clayey plains.

Chenolea eriophora, Aitch. et Hemsley.—*Echinopsilon eriophorum*, Moq.; *Kochia latifolia*, Fresen., Boiss. Fl. Or. iv. p. 927.

Hari-rud valley: 431, May 10, 1885, July 27, 1885. Under the shade of bushes; very common. This plant is extremely prominent from the way it is covered with a snow-white soft wool, which becomes brown in the herbarium.

Kochia scoparia, Schrad.; Boiss. Fl. Or. iv. p. 925.

Khorasan: 812, August 28, 1885. A tall weed, in cultivated ground.

Halostachys caspia, C. A. Mey.; Boiss. Fl. Or. iv. p. 935.

Hari-rud valley: 746, July 29, 1885. In moist saline soil; a shrub reaching four feet in height.

Suæda fruticosa, Forsk.; Hook. fil. Fl. British India, v. p. 13.

Hari-rud valley: 1102, July 29, 1885. Native name *Shorag*. In salt marshy soil; very common.

Suæda salsa, Pall.; Boiss. Fl. Or. iv. p. 942.

Hari-rud valley: 745, July 29, 1885. Covers the saline plains, giving them in early summer a vivid green, and looking at a distance like cultivated crops.

Suæda, sp.

Hari-rud valley: 743, July 29, 1885. In great abundance in the saline plains. A shrub three feet in height; the same as Griffith's 1769, Kew distribution no. 4209.

Haloxylon Ammodendron, Bunge; Boiss. Fl. Or. iv. p. 948.

Northern Baluchistan: 15, Sept. 29, Oct. 3, 4, 1884; Hari-rud valley: 301, April 21, 1885; 326, April 27, 1885; Khorasan: August 21, 1885. Native names: *Ta-ghaz*, *Tar-gaz*, *Tar*, *Tahg*, *Takk*, *Sax-aol*. A small tree or shrub, reaching 14 feet in height, with extremely heavy coarse wood. It is local, although its area extends from the sand hills of Baluchistan, where it is found in great luxuriance, to the banks of the Hari-rud river, and in Khorasan. The Baluchi name, *Tar-gaz*, is applied to it in allusion to the vivid green of its young branches, which are pendulous, and to its general likeness to a Tamarisk. The wood is excellent fuel; and from it is extracted a green dye, *Shakhai-i-tahg*.

I measured the trunk of one specimen at Toman-agha, and it was 12 feet in circumference at its thickest, but branched very low down; and I do not think the whole tree was more than fourteen feet high.

Haloxylon Griffithii, Moq.; Boiss. Fl. Or. iv. p. 950.

Baluchistan: 1, Sept. 25, 1885.

HALOXYLON SALICORNICUM, Bunge; Boiss. Fl. Or. iv. p. 949.

Northern Baluchistan: 55, October 8, 9, 1885. A low shrub, in some quantity at Sha-ismail, in the desert.

SALSOLA FŒTIDA, Del. ?; Boiss. Fl. Or. iv. p. 961.

Northern Baluchistan: 24, Sept. 29, 30, 1885; Hari-rud valley: 720, July 26, 27, 1885. Native names: *Shora, Shorag.* A spreading bush over four feet in height, that occurs more or less frequently from Baluchistan to the valley of the Hari-rud and into Khorasan. One of the forms of soda called *Ishkhar*. *Khar*, a coarse barilla, is said to be obtained from this shrub by burning. From this plant in Baluchistan I collected a kind of manna, which the natives called *Shakar*, not specially identifying it.

SALSOLA KALI, Linn.; Boiss. Fl. Or. iv. p. 954.

Northern Baluchistan: Oct. 14, 1884; Hari-rud valley: 729, July 27, 1885. Very common over the whole country, frequently as a large spreading bush.

SALSOLA RIGIDA, Pallas; Boiss. Fl. Or. ii. p. 962.

Hari-rud valley: 613, June 6, 1885. Very common on the gravelly plains.

SALSOLA AURICULA, Moq.; Boiss. Fl. Or. iv. p. 958.

Hari-rud valley: 600, June 4, 1885; 716, July 26, 1885. Scattered singly and sparsely over the sandy and clayey plains, and remarkable for the deep olive-green colour of its foliage, and orange to light purple flowers.

SALSOLA ARBUSCULA, Pall.; Boiss. Fl. Or. iv. p. 960.

Northern Baluchistan: 14, Sept. 29; 53, Oct. 8, 1884. Native names: *Narruk, Randuk, Randu.* A very characteristic shrub of the desert country, as much as 4 feet in height. Camels are very fond of it; and the natives employ it in preparing the skins for their water-bottles.

SALSOLA SUBAPHYLLA, C. A. Mey.; Boiss. Fl. Or. iv. p. 959.

Hari-rud valley: 717, July 26, 1885. Common in saline soil. A leafless olive-green shrub up to four feet in height; branches very stiff and densely interlaced.

SALSOLA, sp. affinis *S. carinatæ*, C. A. Mey.; Boiss. Fl. Or. iv. p. 955.

Hari-rud valley: 733, July 27, 28, 1885. A shrub about a foot in height, with a soft spongy mass of spreading branches, forming a bush of about four feet across. Flowers pink.

SALSOLÆ, spp. 2.

Baluchistan: 1103, Oct.; 56, Oct. 9, 1884.

NOEA SPINOSISSIMA, Moq.; Boiss. Fl. Or. iv. p. 965.

Khorasan: 802, August 24, 1885. Grows in the form of a dense spinous ball, from the interlacement of its branches. Flowers orange.

GIRGENSOHNIA OPPOSITIFLORA, Fenzl; Boiss. Fl. Or. iv. 967.

Hari-rud valley: 728, July 27, 1885. In dry stony soil, growing among other bushes. It is semiscandent in habit, its hard recurved leaves helping it to climb.

ANABASIS ERIOPODA, Benth. et Hook. f.—*Brachylepis eriopoda*, C. A. Mey.; Boiss. Fl. Or. iv. p. 971.

Hari-rud valley: 774, August 17, 1885. Native names: *Ishlun, Ishlan.* A very peculiar and characteristic plant. The branches spring from a curious, corky, warted, shortened stem, and are furnished with a ring of pure white hairs at the base. The plant is largely employed in the manufacture of a coarse barilla, *Khar, Ishkhar.*

ANABASIS, sp.

Northern Baluchistan: 54, Oct. 9, 1884. A common plant in the desert country; flowers pink.

ANABASIS, sp.

Northern Baluchistan: 42, Oct. 6, 1886. Native name *La-rag.* A small spreading bush, about a foot in height; common in the desert country.

HALOCHARIS SULPHUREA, Moq.; Boiss. Fl. Or. iv. p. 975.

Northern Baluchistan: 34, Sept. 29, 1884; Hari-rud valley: 721, July 26, 1885; Khorasan: June 21, 1885. On saline plains; a foot in height, and spreading so as to form a soft turf.

HALOCHARIS?

Hari-rud valley: 719, July 26, 1885. Common on saline plains. About a foot high, and spreading. The whole plant is hairy, and of a very peculiar blue-grey colour. Flowers light purple.

HALIMOCNEMIS PILOSA, Moq.; Boiss. Fl. Or. iv. p. 976.

Hari-rud valley: 722, July 26, 1885.

HALIMOCNEMIS MOLISSIMA, Bunge; Boiss. Fl. Or. iv. p. 977.

Locality unknown; probably Hari-rud valley, 1152.

HALANTHIUM, sp.

Hari-rud valley: 615, June 6, 1885. A common plant on stony ground; about a foot high, the branches spreading. Flowers straw-coloured. This, I believe, is a plant I also got in some quantity in Baluchistan (No. 38, Oct. 5, 1884), but it was so brittle and dry that the specimens were useless.

POLYGONACEÆ.

CALLIGONUM COMOSUM, L'Hérit.?; Boiss. Fl. Or. iv. p. 1000.

Northern Baluchistan: 30, October 3, 1884. Native name *Phog.* Common in Baluchistan. There was no fruit on the plant when I collected it, but near it the comose fruits of this species were picked up. It yields good fuel, and the young shoots make excellent camel-fodder.

CALLIGONUM, sp.
Hari-rud valley: 267, April 17, 1885. A shrub from four to seven feet high, in the beds of dry water-courses; common.

CALLIGONUM, sp.
Hari-rud valley: 1104, May 9, 1885; Khorasan: July 9, 1885. A tall shrub, with large corky nodes on the main stems, from which the annual flowering shoots are developed. Fruit bright red, winged.

PTEROPYRUM AUCHERI, Jaub. et Spach; Boiss. Fl. Or. iv. p. 1002.
Northern Baluchistan: 46, October 6, 8, 1884; Khorasan: 693, June 18, 1885. Native name *Khar-whang-kush.* A common shrub, two to three feet high, growing in the shingly beds of dry water-courses. Very conspicuous from the profusion of its bright red fruit.

ATRAPHAXIS SPINOSA, Linn.; Boiss. Fl. Or. iv. p. 1020, var. γ. SINAICA, Boiss.
Khorasan: 708, July 1, 1885. A common shrub, in the shingly beds of dry water-courses.

ATRAPHAXIS LÆTEVIRENS, Jaub. et Spach, Ill. Pl. Or. ii. p. 14?
Hari-rud valley: 1105, May 10, 1885. Common in stony places. A shrub attaining five feet in height, spreading ten or twelve feet; in general aspect very like an overgrown, woody *Polygonum.* Fruit greenish white, large.

ATRAPHAXIS LÆTEVIRENS, Jaub. et Spach, Ill. Pl. Or. ii. p. 14?
Hari-rud valley: 274, April 19, 21, 1885. A large spreading bush, in stony localities. It may be the same species as 1105.

POLYGONUM AVICULARE, Linn. (varietates); Boiss. Fl. Or. iv. p. 1036.
Hari-rud valley: 283, April 19, 1885; 779, August 18, 1885.

POLYGONUM AFGHANICUM, Meissn.; Boiss. Fl. Or. iv. p. 1041.
Badghis: 470, May 16, 1885; Khorasan: June 17, 1885. Common at an altitude above 3000 feet.

POLYGONUM BELLARDI, Allioni; Boiss. Fl. Or. iv. p. 1034.
Khorasan: 1153, 696, June 21, 1885. Common, in the rubbish of old buildings.

POLYGONUM, sp.
Badghis: May 17, 1885; Paropamisus: 561, May 25, 1885. On stony ridges, at an altitude above 3500 feet, common. Grows like a miniature sturdy tree, with stout woody branches.

RHEUM RIBES, Gronov.; Boiss. Fl. Or. iv. p. 1003.
Paropamisus range: 397, May 5, 1885. Native names: *Rewash, Rewand, Chukri.*

Common, at an altitude of about 5000 feet. The branches of the inflorescence are collected and eaten raw by the natives. The root is employed in colouring leather.

RHEUM TATARICUM, Linn. fil.; Boiss. Fl. Or. iv. p. 1003. (Plate XLV.)

Hari-rud valley: 319, April 26, 1885. Native names: *Rewash-i-dewana*, *Rewand-i-meghan*, *Ishkin*. In the shingly and clayey soil of the great gravel-plains to the north of Tomanagha. A characteristic plant of these plains, remarkable from the large size of its foliage, and the manner in which it lies spread out on the ground. The fruit and roots are employed as a purgative.

RUMEX ORIENTALIS, Bernh.; Boiss. Fl. Or. iv. p. 1009.

Badghis: 538, May 22, 1885; Khorasan: June 6, 1885. In damp localities, near running water, at an altitude of above 2000 feet; common. I have seen specimens seven feet high.

RUMEX DENTATUS, Linn.; Boiss. Fl. Or. iv. p. 1013.

Hari-rud valley: 438, May 11, 1885. In cultivated ground, and on the sides of irrigation-channels; common.

THYMELÆACEÆ.

THYMELÆA ARVENSIS, Lam.—*Lygia Passerina*, Fasan.; Boiss. Fl. Or. iv. p. 1052.

Hari-rud valley: 769, August 5, 1885.

STELLERA LESSERTII, C. A. Mey.; Boiss. Fl. Or. iv. p. 1051.

Locality unknown: 1106, 1885.

Var. β. **ANGUSTIFOLIA**, Boiss. Fl. Or. iv. p. 1051.

Northern Baluchistan: 50, Oct. 10, 1884; Khorasan: 818, Sept. 2, 1885. In Baluchistan, native name *Phalitha*. An undershrub, in general appearance very like Myrtle. Common in stony and rocky ground; injurious to camels that browse on it.

DIARTHRON CARINATUM, Jaub. et Spach.—*Diarthron vesiculosum*, Fisch. et Mey.; Boiss. Fl. Or. iv. p. 1054.

Hari-rud valley: 417, May 10, 1885; 593, June 3, 4, 1885. Common, in stony ground.

ELÆAGNACEÆ.

ELÆAGNUS HORTENSIS, Bieb.; Boiss. Fl. Or. iv. p. 1056.—*E. angustifolia*, Linn. Sp. Pl. ed. i. p. 121.

Hari-rud valley: August 5, 1885; Badghis: 353, May 1, 1885, May 22, 1885; Paropamisus range: May 26, 1885; Khorasan: June 16, 1885: wild in all the localities named. Khorasan: June 15, 1885, from cultivated trees. Native names: *Sanjit*, *Sinjit*. A shrub or tree, at an altitude of 3000 feet and upwards, near running streams. Cultivated largely in orchards for its fruit.

BALANOPHOREÆ.

Cynomorium coccineum, Linn.; Boiss. Fl. Or. iv. p. 1073.

Hari-rud valley: 454, May 12, 1885. Collected in a wheat-field on two occasions; must be common, as it is well known to the people.

Balanophora, sp.

Helmand river: Oct. 21, 1884.

In a tamarisk-grove on the banks of the Helmand, a large species of *Balanophora* was collected by a camel-driver, who called it *Labbu*, and said that it was used as fodder for camels in Baluchistan. In this he may have been mistaken, as an *Orobanche*, employed for the same purpose, bears the same name. Specimen lost.

EUPHORBIACEÆ.

Euphorbia cæladenia, Boiss. Fl. Or. iv. p. 1094.

Badghis: 1107, May 1, 1885. Native name *Gao-turganak*. In clayey soil, common. This is perennial, and not, as described by Boissier, an annual.

Euphorbia osyridea, Boiss. Fl. Or. iv. p. 1092.

Northern Baluchistan: 1109, October 10, 12, 1884; Hari-rud valley: August 5, 1885. Native name *Gishár*. Common on limestone formation. A perennial that in autumn throws out from a large root-stock long whip-like leafy shoots, which bear flowers in the following spring.

Euphorbia cheirolepis, Fisch. et Mey.; Boiss. Fl. Or. iv. p. 1089.

Northern Baluchistan: 9, Sept. 29, 1884. Native names: *Palti*, *Roj-ghad*. A very common plant that grows in the pure loose sand of the desert, between Nushki and Sanduri.

Euphorbia Chamæsyce, Linn.; Boiss. Fl. Or. iv. p. 1088.

Khorasan: 796, August 23, 28, 1885.

Euphorbia turcomanica, Boiss. Fl. Or. iv. p. 1087.

Hari-rud valley: 1110, June 5, 1885.

Euphorbia helioscopia, Linn.; Boiss. Fl. Or. iv. p. 1107.

Hari-rud valley: 231, April 13, 25, 1885. In cultivated ground, common.

Euphorbia densa, Schrenk; Boiss. Fl. Or. iv. p. 1091.

Hari-rud valley: 179, April 6, 7, 15, 19, 27, 1885, June 3, 1885. This is the common *Euphorbia* of the country, found everywhere in the shade of rocks and bushes.

Euphorbia Szovitsii, Fisch. et Mey.; Boiss. Fl. Or. iv. p. 1113.

Khorasan: 707, July 1, 1885. In gravelly soil.

Euphorbia, sp.

Helmand river: 72, October 21, 1884. Native name *Shir-go*. Employed as a dye.

EUPHORBIA, sp. affinis *E. cœladeniæ*.
Badghis: 1108, May 20, 1885.

EUPHORBIA, sp.
Khorasan: 678, June 18, 1885. A perennial, about eighteen inches in height, growing on dry, hot, stony, exposed hill-sides, at an altitude above 5000 feet. A very characteristic plant of the region.

EUPHORBIA, sp.
Khorasan: 640, June 16, 1885. In clefts of limestone rocks, at an altitude above 5000 feet. Easily mistaken for a Fern at a distance.

EUPHORBIA, sp., near *E. Chamæsyce*, Linn.
Northern Baluchistan: 51, October 9, 1884. Growing in pure loose sand.

ANDRACHNE TELEPHIOIDES, Linn.; Boiss. Fl. Or. iv. p. 1138.
Hari-rud valley: 433, May 10, 1885.

CHROZOPHORA TINCTORIA, A. Juss.; Boiss. Fl. Or. iv. p. 1140.
Helmand river: 70, 732, October 20, 1884; Hari-rud valley: July 27, 1885. Native name, on the Helmand, *Kap-o-chist*. Common in and near cultivated fields.

RICINUS COMMUNIS, Linn.; Boiss. Fl. Or. iv. p. 1143.
Hari-rud valley: Khorasan, 1111. Native names: *Baz-anjir*, *Buz-anjir*. The Castor-oil plant is cultivated along the banks of irrigation-channels, and amongst melon-crops, for its seeds, from which oil is extracted for burning. The use of the oil as a purgative is unknown to the natives of these regions.

URTICACEÆ.

ULMUS CAMPESTRIS, Linn., var.; Boiss. Fl. Or. iv. p. 1157.
Khorasan: 711, July 11, 1885. A cultivated tree, yielding fair timber.

ULMUS MONTANA, Stokes; Boiss. Fl. Or. iv. p. 1158.
Hari-rud valley: 1112, June 5, 1885. Native names: *Pash-e-khar*, *Pash-e-kham*, *Grez*. A cultivated tree, 30 feet high and 9 feet in circumference. Highly valued for its timber.

A variety was collected in the Hari-rud valley: 458, May 12, 1885. It is a good-sized shrub on the sides of irrigation-channels. In all probability not indigenous in the localities where it was collected.

CELTIS CAUCASICA, Willd.; Boiss. Fl. Or. iv. p. 1156.
Badghis: 510, May 18, 1885. Native name *Tohkhm*. An indigenous tree, said to be common in the Badghis, where it grows to a large size, and its timber is in general use. The Afghans have a superstitious veneration for it. The fruit is converted into flour and mixed with wheat-flour in making bread.

Humulus Lupulus, Linn.; Boiss. Fl. Or. iv. p. 1152.

Between Asterabad and the Caspian: 1113, October 30, 1885. This, with other shrubs, forms impenetrable hedges. It is indigenous over the whole country between the base of the mountains at Asterabad and the Caspian Sea.

Cannabis sativa, Linn.; Boiss. Fl. Or. iv. p. 1152

Khorasan: 1114, August 25, 1885. I never met with a single indigenous specimen of this plant. At Rui-Khauf it was cultivated by some Hindoos.

Morus alba, Linn.; Boiss. Fl. Or. iv. p. 1153.

Badghis: 507, May 18, 1885. Native names: *Tuth*, *Tut*. An indigenous tree near water, at an altitude above 3000 feet. Extensively cultivated in orchards for feeding silkworms, and also for its fruit, which is eaten in a fresh state as well as dried; in the latter state it is made into bread with flour.

Ficus Carica, Linn.; Boiss. Fl. Or. iv. p. 1154 (varietates). (Plate XLVI.)—*F. Johannis*, Boiss. Diagn. ser. 1, vii. p. 96.—*F. geraniifolia*, Miq. in Hooker's Lond. Journ. Bot. vii. p. 225, et Over de Africaanische Vijge-boomen, p. 18, t. 2, c.—*F. persica*, Boiss. loc. cit. ?

Badghis: 481, May 16, 19, 18, 1885; Khorasan: 1115, August 18, 1885. Native names: *Anjir*, *Anjir-kohi*. Of shrubby habit, reaching 12 feet in height, inhabiting clefts of rocks and escarpments of hill-sides; not uncommon. It was first seen at Tirphul and subsequently in great abundance on the rocks at Sim-koh. There were both yellow- and purple-fruited varieties. The Fig is largely cultivated for its fruit in Afghanistan, as well as in Persia.

Both the male and the female of *Ficus Carica* appear to be indigenous in the Badghis country and Eastern Persia, though DeCandolle ('Origine des Plantes Cultivées,' p. 237), as the result of his researches, restricts the area of the prehistoric Fig to the Mediterranean region, from Syria to the Canary Islands. Of course, it is very difficult to judge where a plant that has been cultivated for ages is really indigenous. It may occur in a wild state, but whether it has descended from originally wild progenitors or from cultivation, it is almost impossible to say, especially in countries formerly more generally inhabited and cultivated than at present. Yet the Fig, both male and female, seems to be as much at home in the districts named as blackberries in England, and the fact of the two sexes being equally common in a wild state points to its being indigenous.

Most readers interested in the subject of the fertilization of plants and the sexual relationships of the Fig and Caprifig will be acquainted with the results of the investigations of Saunders and Westwood in this country, and of Solms and Fritz Müller among foreign writers*. In this connection we have carefully examined the different forms collected, with the result that we find some of the specimens bearing receptacles which contain male flowers and "gall-flowers" (in other words, female flowers which are always infested by insects and yield no perfect seeds), and some of them bearing receptacles containing only female flowers, which produce perfect seeds. This is of so much interest that it has been thought worth while to devote a Plate to their illustration; and it was at first decided to figure the insects as well, but that has been left for a specialist to do, should it prove of sufficient interest. Both male and female insects were found, closely resembling those figured in Gasparrini's work*. Drawings of these, made by Miss M. Smith, together with a portion of an infested fruit, were forwarded to Mr. O. Westwood, who, although suffering from illness and unable to examine the material thoroughly, kindly replied that the insects are a species of *Blastophaga*, seemingly smaller than *B. Psenes*, Linn. "The female insects have the large, broad fore wings, with the strong, curved, stigmal branch, short, nearly quadrate mandibles furnished at the base with the curious oval, flat, serrated appendage which is so characteristic of the genus. The little fulvous ill-shaped wingless males agree with those of *Blastophaga Psenes*."

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* It may be mentioned that Mr. W. B. Hemsley has summarized Solms and Müller's various articles on this subject in the 'Gardener's Chronicle,' n. s. xix. pp. 529 and 572, and xxv. p. 265, and in 'Nature,' xvii. p. 584.

As may be seen from the drawings, the specimens exhibit great variety in the foliage as well as in the length of the peduncles and the shape of the figs (or receptacles), which are either sessile or more or lese stipitate. The functionally male specimens collected agree exactly with Miquel's *Ficus geraniifolia* and Boissier's *F. Johannis*; and there is little doubt that *F. persica*, Boissier, which appears to be a female form, is also *F. Carica*, though the specimens we have seen are insufficient to establish this satisfactorily. Some further particulars are given in the description of the Plate; but how far shape of receptacle, length of peduncle, and other characters coincide with the sexes, the specimens are insufficient to determine, though there is considerable variation in both sexes. Generally it may be said of the specimens examined, that the female receptacles are more or less pear-shaped, stipitate, and borne on relatively short peduncles, whereas the male receptacles are apple-shaped or spheroidal, shortly stipitate, and borne on long peduncles.

PARIETARIA OFFICINALIS, Linn.; Boiss. Fl. Or. iv. p. 1149.

Khorasan: 637, June 16, 1885. In clefts, on the shady side of limestone rocks, at altitudes above 5000 feet; common.

PLATANACEÆ.

PLATANUS ORIENTALIS, Linn.; Boiss. Fl. Or. iv. p. 1161.

Khorasan: 629, June 15, 1885. Native name *Chanar*. A cultivated tree in villages of Afghanistan and Persia. The wood is largely employed, especially in making the gates that open into a village. Some very large trees are said to exist at Maimannah.

JUGLANDEÆ.

JUGLANS REGIA, Linn.; Boiss. Fl. Or. iv. p. 1160.

Khorasan: 627, June 15, 1885. Native name *Jaoz*. Largely cultivated at an altitude above 3000 feet, where there is a good supply of water. The fruit is an article of export from Afghanistan and Persia to India.

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* Ricerche sulla Natura del Caprifico e del Fico e sulla Caprificazione, 1845.

SALICINEÆ.

Salix pycnostachya, Anders.; DC. Prodr. xvi. pt. 2, p. 309.

Khorasan: 1116, June 16, 1885. A small indigenous tree, on the borders of streams, at an altitude of 4000 feet.

Salix Daviesii, Boiss. Fl. Or. iv. p. 1184.

Hari-rud valley: 211, April 13, 1885; 247, April 16, 1885. Native name *Bed*, which is the generic term for all willows; in Baluchistan *Get*. A cultivated tree of large size, on the banks of irrigation-channels.

Salix acmophylla, Boiss. Fl. Or. iv. p. 1183.

Badghis: 503, May 18, 1885. A small indigenous tree, in the vicinity of running water, at Sim-koh.

Salix babylonica, Linn.; Boiss. Fl. Or. iv. p. 1185.

Hari-rud valley: 1117, August 5, 1885. A large tree, on the banks of streams, at the base of Mount Do-shakh; indigenous and cultivated. I believe I saw the same species in the Badghis near Kushk.

Salix alba, Linn.; Boiss. Fl. Or. iv. p. 1185.

Hari-rud valley: April 25, 1885; 1118, June 5, 1885. Native name *Bed-i-siah*. A large tall tree, with dark bark; hence its native name. Cultivated in villages.

Salix songarica, And.; DC. Prodr. xvi. pt. 2, p. 213.

Hari-rud valley: 606, June 5, 1885. Native name *Bed-i-surkh*. A large tree, cultivated near villages. It obtains its native name from the red colour of its bark.

Populus euphratica, Oliv.; Boiss. Fl. Or. iv. p. 1194.

Badghis: March 19, 1885; Hari-rud valley: 1119, April 11, 1885. Native names: *Padda, Paddak*. An indigenous tree, on the Helmand, the Hari-rud, in the Badghis district, and on the Bala-morghab river, where, in many localities, it forms forests. The timber is of good size, but poor in quality, and is chiefly employed for fuel. Its foliage is excellent fodder for camels. At Nushki were several cultivated trees; one of these measured nine feet six inches in circumference at six feet from the ground. Except near shrines I have not seen it cultivated.

Populus nigra, Linn.; Boiss. Fl. Or. iv. p. 1194.

Hari-rud valley: 1120. Native name *Safedar*. Cultivated in gardens and orchards, in this part of Afghanistan; certainly not common.

GNETACEÆ.

Ephedra pachyclada, Boiss. Fl. Or. iv. p. 713? (Plate XLVII. figs. 1–10.)

Native names: *Hum, Huma, Yehma*. Hari-rud valley: 1122, April 26, 1885; June 4, 1885. A very common shrub, from Northern Baluchistan along our whole route, in the

Hari-rud valley, the Badghis district, and Persia, growing in stony gravelly soil. The small red fruit is eaten; the branches are employed in tanning the skins of goats for water-bottles, and their ashes, when burnt, mixed with, or employed in lieu of snuff.

There are no authentic fruiting specimens of Boissier's species at Kew, and we are not at all confident that we are right in referring our specimens to *E. pachyclada.* Boissier states that the only monœcious species of *Ephedra* observed by him was his *E. foliata*, but we find a few male flowers associated with the females on some of the specimens of the present species.

EPHEDRA SARCOCARPA, Aitch. et Hemsl. (Plate XLVII. figs. 11–15.) *Frutex* 4–5-pedalis, aphyllus, ramulis subverticillatis crassiusculis multistriatis, vaginis brevibus acuminatis. *Amenta* feminea tri- vel interdum biflora, in axillis vaginarum subsessiles vel pedunculata, interdum longiuscule; bracteæ carnosæ, 9, triseriatæ, floribus 3 (rarissime 8, quadriseriatæ, floribus 2), exteriores parvæ, interiores magnæ, anguste membranaceo-marginatæ. *Nuculæ* ovoideo-trigonæ, nitidæ.

Hari-rud valley: 739, July 27, 1885. A shrub resembling *E. pachyclada*, Boiss., but altogether a much larger plant, and the brilliant scarlet fruit twice as large.

To this probably belongs No. 49 from Baluchistan.

EPHEDRA FOLIATA, Boiss. et Kotschy, Fl. Or. v. p. 716.

Native name *Hum-i-bandak.* Badghis: 477, 1121, May 16, 18, 1885. A shrub reaching nine feet in height, with long bending branches, which are very knotty, and resemble *Calligonum*, sp., No. 1104. Common in the Badghis, especially in exposed localities.

EPHEDRA DISTACHYA, Linn.; Boiss. Fl. Or. v. p. 713 (varietates?).

Hari-rud valley: 174, June 6, 1885, male flowers; May 10, 1885, female flowers. A common shrub.

EPHEDRA, sp.

Khorasan: 1123, June 18, 1885. At an altitude above 5000 feet, amongst boulders, common.

This and the next may belong to *Ephedra distachya*; but the species of this genus are very difficult of determination from mere comparison; and we had not time to examine critically a large number of specimens.

EPHEDRA, sp.

Khorasan: 1124, August 20, 1885. A large shrub, bearing male flowers only.

EPHEDRA, sp.

Northern Baluchistan: 43, October 10, 1884. In low rocky hills.

CONIFERÆ.

Juniperus excelsa, Bieb.; Boiss. Fl. Or. v. p. 708.

Badghis: December 6, 1884; Paropamisus range: 1125, May 25, 1885. Native names: *Archa, Ors, Orsa.* A large tree, common and, in many places, forming good forests, at altitudes above 4500 feet. Its timber is employed extensively for all purposes and for fuel.

Pinus halepensis, Mill.; Boiss. Fl. Or. v. p. 695.

Khorasan: 1126, August 23, 1885. Native name *Naoju.* Cultivated round gardens and orchards to break the force of the wind. Also common near shrines. The cone and the tree both go by the same native name. The timber is largely employed in the wood-work of houses.

ORCHIDEÆ *.

Orchis latifolia, Linn.; Boiss. Fl. Or. v. p. 71.

Khorasan: 675, June 18, 1885. In moist meadow-land, at 3000 feet altitude and upwards; common; Badghis and Khorasan. The tubers, called *Salap* or *Salab*, exported in some quantity from Persia by way of Herat to India.

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* Dr. H. G. Reichenbach has kindly contributed the following rectification of the determination of one of my Kuram Orchids:—

Habenaria Aitchisoni, Reichb. f., n. sp.; tuberidiis cylindraceis, foliis suboppositis transverse ellipticis, acutis, pedunculo longe exserto, distanter vaginato, vaginis triangulis acutis; racemo densifloro, subsecundo, bracteis triangulis, acutis, uninerviis; ovaria pedicellata dimidia subæquantibus: sepalis tepalisque rostrato-conniventibus; sepalis triangulis, trinerviis, tepalis subæqualibus basi interna subangulatis: labelli tripartiti partitionibus linearibus acutis, lateralibus nunc divaricatis, calcari filiformi apicem versus ampliato, nunc uncato, ovarium pedicellatum non æquante: cruribus stigmaticis retusis basi nunc connatis.—"*Habenaria brachyphylla*, Lindl.," Aitchison! in Journ. Linn. Soc. Bot. xix. p. 188. Flores belle virides: "bright green." Cl. Aitchison cum magno gaudio dicata.

Darban valley, Kuram district, "in solo argillaceo sylvarum, alt. 7500 ped.," Aitchison!

Specimina Kewensia ejusdem speciei sequentia Sikkim 10,000–11,000 ped., J. D. Hooker, no. 59 Herb. Ind. Or. (no. 303 MSS.) (qui plantam statu pulcherrimo sine dubio detexit). Lali valley above Budhi 10,000–11,000 ped., J. F. Duthie! Murree Himal. 7000 ped., Aitchison! Herb. Falconeri, no. 1036, Kew Distrib. sine loco.

Plantæ duæ affines sunt.

Habenaria brachyphylla, Reichb. f.—*Platanthera brachyphylla*, Lindl. Orch. p. 293!; Wight. Icon. v. t. 1694! *Habenaria crassifolia*, A. Rich. in Ann. Sc. Nat. sér. 2, vol. xv. p. 72, t. 3 c (1841). Recedit vaginis in caule crebris, inflorescentia bene spirali, sepalis crassioribus brevioribus, latioribus, acutis, lateralibus revolutis, tepalis ellipticis uninerviis nervulo altero brevissimo nunc addito, supra basin angulatis, labelli tripartiti, partitionibus abbreviatis, latioribus, cruribus stigmaticis minutis vere absconditis, calcari magis æquali recto descendente. Flores dicti viridi-albi, calcari viridi (flowers greenish white, spur green).

Specimina in herbariis Kewensibus numerosa. Typus Lindleyi (*Gymnadenia brachyphylla*, Hb. Wight.), Nilgherries, Wight!, Perrottet! 1322, Katery Nilag. Metz.! Ghats, near Tooneea in the Deccan, Aug. 1852, Stocks! Khasia Hills, Lobb!

Similis præterea huic plantæ est *Habenaria vaginata*, A. Rich. in Ann. Sc. Nat. sér. 2, vol. xiv. p. 269, t. 17, II. (1840). Hæc planta Abyssinica optime recedit tepalis magis lunatis, labelli partitionibus lateralibus divaricatis nec antrorsis, cruribus stigmaticis maximis retusis.

Reliquæ species foliis basiliaribus sunt hæ:—1. *Habenaria platyphylla*, Spreng. 2. *Habenaria plantaginea*, Lindl. 3. *Habenaria rotundifolia*, Lindl. (*Habenaria diphylla*, Dalz. typica herb. Dalzell in herb. Kewensi).

ORCHIS LAXIFLORA, Lam.; Boiss. Fl. Or. v. p. 71.

Badghis: 534, May 22, 24, 1885. In similar localities to *O. latifolia*, and equally common. The tubers of this are collected with those of *O. latifolia*, and, mixed with them, are exported as *Salab* or *Salap*.

IRIDEÆ.

IRIS SOONGARICA, Schrenk; Boiss. Fl. Or. v. p. 126.

Hari-rud valley: 317, April 25, 26, May 12, June 5, 1885; Badghis: May 21, 1885. Extremely common on the great gravelly plains, in shingly soil, growing in large clumps; flowers pale mauve.

IRIS GUELDENSTAEDTIANA, Lepech.; Boiss. Fl. Or. v. p. 129.

Khorasan: 683, June 18, 1885. In meadow-land, close to running water, at an altitude of 5000 feet. Flowers greenish white.

IRIS FALCIFOLIA, Bunge; Boiss. Fl. Or. v. p. 133.

Hari-rud valley: 154, April 3, 6, 7, 21, 1885. In shingly soil, on the great gravelly plains; common. Flowers of a dingy smoky purple.

IRIS SISYRINCHIUM, Linn.; Boiss. Fl. Or. v. p. 120.

Hari-rud valley: 309, April 25, 1885. In clay soil on the banks of the river.

IRIS (§ JUNO) FOSTERIANA, Aitch. et Baker, n. sp.; bulbo ovoideo-fusiformi tunicis exterioribus membranaceis sordide brunneis, caule brevi erecto 1–2-cephalo, foliis productis 5–6 lanceolatis complicatis distichis falcatis venis exsculptis scabris marginibus incrassatis albidis, spathæ valvis exterioribus oblongis viridibus margine hyalinis membranaceis, pedicello brevi, ovario cylindrico-trigono, tubo infundibulari limbo æquilongo, limbi segmentis exterioribus obovato-unguiculatis deflexis violaceis, interioribus pallide luteis erectis limbo parvo obovato ungue lato triplo breviore.

Bulbus 2–3-pollicaris, 9–12 lin. diam., tunicis multis brunneis, fibris radicalibus carnosis copiosis. *Folia* exteriora pauca parva membranacea; producta trijuga conferta semipedalia valde complicata, deorsum 5–6 lin. lata, venis crebris exsculptis, marginibus cartilagineis incrassatis. *Spatha* ventricosa bipollicaris. *Perianthium* bipollicare, tubo luteo anguste infundibulari ore 3–4 lin. diam., segmentis exteri-

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4. *Habenaria Sutteri*, Reichb. in Linnæa, vol. xxv. p. 229! (1852).—*H. Jerdoniana*, Wight, Icon. v. t. 1715 (1852). Nescio quid nomen prius fuerit divulgatum.—*Platanthera canarensis*, Lindl. MSS. in Hohenacker, Pl. Ind. Or. Canara, no. 142, and in Hook. & Thoms. Herb. Ind. Or.

5. *Habenaria Josephi*, Reichb. f., n. sp. *Neottiam* (*Listeram*) ludens, tuberidiis cylindraceo-ovoideis, foliis binis oppositis elliptico-acuminatis, racemo 2–4-floro, laxifloro, bracteis triangulo-lanceis ovaria pedicellata non æquantibus, ovario curvo, sepalo impari-fornicato triangulo, sepalis lateralibus oblongis acutis deflexis, tepalis triangulis antrorsum inferne angulatis, labelli partitionibus lateralibus setaceis, partitione mediana lineari-lancea, breviore calcari filiformi apicem versus clavato, ovarium pedicellatum subæquante, cruribus stigmaticis abbreviatis. Sikkim 12,000–19,000 ped., J. D. Hooker, no. 42, Herb. Ind. Or. cui magno cum gaudio dicata. Plantula parva pauci-pollicaris.

6. *Habenaria Dregeana*, Lindl., et species quædam ineditæ.

oribus pulchre violaceis 1 poll. latis, interioribus 18 lin. longis, ungue plano glabro 4–4½ lin. lato. *Styli* pollicares pallide lutei, cristis magnis deltoideis. *Antheræ* luteæ filamentis æquilongis.

Ab *I. caucasica* recedit perianthii segmentis exterioribus magnis violaceis limbo obovato.

Badghis: 128, March 15, 1885. In clay soil, on the low hills at an altitude of 3000 feet, common. Flowers bright yellow, with large purple falls; a very handsome species.

IRIS (§ JUNO) DREPANOPHYLLA, Aitch. et Baker, n. sp.; bulbo parvo ovoideo tunicis exterioribus membranaceo-fibrosis, foliis productis 6–8 lanceolatis acuminatis spiraliter recurvatis distichis complicatis marginibus albidis incrassatis ciliatis, caule brevi 1–4-cephalo, spathæ valvis apice acuminatis membranaceis, perianthio pallide luteo tubo gracili apice dilatato, limbi segmentis interioribus linearibus minimis patulis, exterioribus obovato-cuneatis limbo reflexo ungue suberecto triplo breviore.

Bulbus 6–9 lin. diam., tunicis exterioribus demum fibrosis, collo hypogæo elongato gracili, fibris radicalibus paucis basi carnosis. *Folia* semipedalia pallide viridia basi 9–12 lin. lata, venis haud confertis leviter exsculptis. *Spathæ* terminales et ad foliorum axillas productæ, bipollicares, valvis apice et margine hyalinis. *Perianthium* 2½–2¾ poll. longum, tubo apice solum ampliato, segmentis interioribus minimis linearibus, exterioribus tubo æquilongis, ungue suberecto pollicari, limbo obovato parvo. *Styli* pollicares, cristis parvis deltoideis. *Stamina* stylis æquilonga.

Habitus et folia omnino *I. caucasicæ*. Recedit limbi segmentis interioribus minutis, exterioribus limbo parvo ungue triplo breviore.

Hari-rud valley: 173, April 6, 1885; Badghis: April 29, 1885. In clay soil, where it is occasionally flooded; not very common. Flowers bright yellow.

CROCUS KOROLKOWI, Regel & Maw; Maw, The Genus *Crocus*, p. 275, pl. 56; Boiss. Fl. Or. v. p. 109.

Badghis: 109, January 20, March 9, April 1, 1885. In abundance throughout the Badghis; commences to flower as early as the middle of December.

CROCUS SPECIOSUS, Bieb.; Boiss. Fl. Or. v. p. 114.

Asterabad, Persia: 1128, October 1885. In grass-land, abundant. Flowering in the autumn.

GLADIOLUS KOTSCHYANUS, Boiss. Diagn. ser. i. 13, p. 15.—*Gladiolus imbricatus*, Linn.; var. β. *Kotschyanus*, Boiss. Fl. Or. v. p. 141.

Khorasan: 668, June 17, 1885. A weed in cultivated land; common in the Badghis as well as Khorasan.

AMARYLLIDEÆ.

UNGERNIA TRISPHÆRA, Bunge; Boiss. Fl. Or. v. p. 149.

Hari-rud valley: 741, July 28, 1885. Native name *Pias-kuki*. Common in clay soil all over the country, also in Khorasan and the Badghis. Leaves nine inches long, and three inches broad, appearing in early summer, and dying down at the end of summer, when

they are succeeded by a loose umbel of five or six handsome flowers, varying in colour from rose-pink to salmon.

The bulbs are flask-shaped, from six to nine inches in length, of almost a black colour, consisting of an immense number of very thin, papery, black tunics covering the true bulb. From the bulb proceed several thick, fleshy roots, like those of some *Eremuri*, as well as small fibrous ones.

Said to be employed in feeding camels.

IXIOLIRION MONTANUM, Herb.; Boiss. Fl. Or. v. p. 154.

Hari-rud valley: 268, April 18, 19, 1885, May 9, 1885. In gravelly soil, at the base of low hills close to the river; common.

LILIACEÆ.

ASPARAGUS BRESLERIANUS, Roem. & Schult.—*Asparagus maritimus*, Pall., var. *Breslerianus*, Boiss. Fl. Or. v. p. 337.

Hari-rud valley: 1129, July 27, 1885. In thickets of tamarisk, on land that is flooded by the river. Fruit bright red.

ASPARAGUS VERTICILLATUS, Linn.; Boiss. Fl. Or. v. p. 339.

Hari-rud valley: 303, April 21, 1885, June 6, 1885. In tamarisk thickets occupying the bed of the river.

EREMURUS SPECTABILIS, Bieb.; Boiss. Fl. Or. v. p. 322.

Hari-rud valley: May 13, 1885; Badghis: 546, May 22, 23, 1885. Abundant in the loamy, sandy soil of the Badghis, from two to five feet in height. The showy part of the flower is not the perianth, but the long purple stamens bearing sulphur-coloured anthers.

EREMURUS AURANTIACUS, Baker.—*Eremurus Bungei*, Baker, var. β. *stenophyllus*, Boiss. Fl. Or. v. p. 324.

Khorasan: 644, June 16, 1885. Common in the hills to the south of Bezd, above an altitude of 5000 feet, associated with *E. Olgæ*. Flowers lemon-coloured. Leaves eaten as a vegetable.

EREMURUS LUTEUS, Baker; Boiss. Fl. Or. v. p. 327.

Hari-rud valley: 191, April 7, 10, 19, 1885; Badghis: May 4, 1885. Excessively common on the low clay-hills. Flowers greenish white; in the process of drying the colour alters to a yellow.

EREMURUS VELUTINUS, Boiss. & Buhse; Boiss. Fl. Or. v. p. 324.

Hari-rud valley: 402, May 9, 13, 1885. In sandy gravel, on the great plains; common. Flowers inconspicuous.

EREMURUS AUCHERIANUS, Boiss. Fl. Or. v. p. 326; var. β. *Korolkowi*, Regel, Descript. Plant. Nov. Turkest. 1884, fasc. ix. p. 27.

Badghis: 387, May 3, 21, 1885. Native name *Siresh*. Profuse in the sandy loam of the Badghis. The long fleshy roots and, some say, the leaves also, of this species are collected and dried in an oven, then ground into powder, which is converted into a thick jelly by boiling in water. This is employed in the manufacture of various vessels, called *Dabba*, for holding oil and clarified butter. There is a great trade in this material at Rui-Khauf in Khorasan. The introduction of this into India would, I feel sure, be highly prized by the Hindoo community, who would thus obtain vessels made of vegetable substance, in place of those at present employed in the oil and *ghi* (clarified butter) trade, viz. made of animal skins.

Other species of the genus probably yield a similar substance.

EREMURUS OLGÆ, Regel, Descript. Plant. Nov. Turkest. 1884, fasc. ix. p. 29.

Paropamisus range: 566, May 25, 1885; Khorasan, June 16, 1885. On slopes of hill-sides and in fields, between 4000 and 5000 feet altitude, in great luxuriance. One of the finest of the many flowering plants obtained on this expedition. The inflorescence usually salmon-coloured, occasionally pure white.

ALLIUM (§ SCHŒNOPRASUM) LEUCOSPHÆRUM, Aitch. et Baker, n. sp.; bulbis anguste ovoideis cæspitosis tunicis exterioribus membranaceis pallide brunneis apice fibrosis, caulibus gracilibus teretibus interdum geminis, foliis 3–6 gracilibus subulatis superpositis vaginis albis pulchre purpureo-striatis, umbellis densis globosis, spathæ valvis parvis ovatis membranaceis, pedicellis brevibus flexuosis, perianthio campanulato parvo segmentis oblongis subacutis albis viridulo carinatis, staminibus inclusis filamentis ovatis acuminatis.

Bulbi 5–6 lin. diam., tunicis exterioribus membranaceis ferrugineis, nervis crebris parallelis anastomosantibus. *Pedunculus* pedalis et ultra. *Folia* semipedalia glabra basi vix ultra ½ lin. diam., vaginis imbricatis hyalinis venis parallelis pulchre purpureis. *Umbellæ* densæ, 12–15 lin. diam., spathæ valvis fugacibus 3–4 lin. longis, pedicellis demum 4–6 lin. longis. *Perianthium* 2 lin. longum, segmentis valde imbricatis oblongis subacutis costa viridula demum brunneola.

Ad *A. sabulosum*, Stev., et *A. rubellum*, Bieb., magis accedit.

Hari-rud valley: 412, May 9, 10, 1885. Very common in stony soil and in cultivated land.

ALLIUM RUBELLUM, Bieb., var. GRANDIFLORUM, Boiss. Fl. Or. v. p. 253.

Badghis: 527, May 21, 1885. Common in gravelly soil. Flowers rose-pink.

ALLIUM BRAHUICUM, Boiss. Fl. Or. v. p. 278.

Hari-rud valley: 429, May 10, 1885. Common in stony soil on the low hills on both sides of the Hari-rud near Tirphul. A most conspicuous plant, for its large inflorescence. It is in all probability the same as *A. caspium*, Willd.

ALLIUM MACLEANI, Baker in Bot. Mag. tab. 6707.

Badghis: 356, 463, May 14, 18, 1885. Covers the meadows of the Badghis; growing frequently to four feet in height. Flowers purple, colouring the country.

ALLIUM (§ MOLIUM) YATEI, Aitch. et Baker, n. sp.; bulbis solitariis ovoideis tunicis exterioribus firmulis apice fibrosis, caule gracili tereti pedali vel sesquipedali, foliis 1–3 linearibus ciliatis, umbellis densis multifloris, spathæ valvis brevibus ovatis, pedi-

cellis flore demum 2–4-plo superantibus, perianthio rubello segmentis oblongo-lanceolatis, staminibus inclusis filamentis longe monadelphis e basi ovata lanceolatis.

Bulbus rectus, ovoideus, 6–9 lin. diam., tunicis multis in squamas lanceolatas apice fibrosas dissolutis. *Folia* subbasalia haud superposita 6–9 poll. longa, 3–4 raro 5–6 lin. lata. *Umbella* 20–30-flora, pedicellis strictis ascendentibus rubellis demum 6–12 lin. longis. *Spathæ valvæ* membranaceæ, 5–6 lin. longæ. *Perianthium* 3–4 lin. longum pallide rubellum, segmentis acutis saturate rubello-costatis. *Stamina* perianthio distincte breviora, basi in cupulam magnam campanulatam ad perianthium adnatam coalitis. *Stylus* brevissimus. *Capsula* globoso-trigona, 3 lin. longa et lata.

Ad *A. roseum*, Linn., et *A. Thomsoni*, Baker, magis accedit.

Hari-rud valley : 289, April 21, 26, 1885 ; 414, May 9, 1885. Common in stony ground.

ALLIUM (§ RHIZIRIDIUM) XIPHOPETALUM, Aitch. et Baker, n. sp.; (Plate XLVIII.) bulbis cæspitosis ovoideo-oblongis, tunicis fibrosis, foliis productis 3 linearibus glabris superpositis, caulibus teretibus elongatis, umbellis multifloris densifloris, spathæ valvis 2–3 ovatis floribus brevioribus, pedicellis strictis ascendentibus floribus longioribus, perianthio rubello segmentis lanceolatis acuminatis, staminibus inclusis filamentis linearibus vel supra basin subulatis basi longe monadelphis.

Bulbi oblique congesti, fibris radicalibus copiosis gracilibus elongatis, tunicis exterioribus reticulato-fibrosis. *Caulis* sesquipedalis vel bipedalis modice validus. *Folia* semipedalia 2–3 lin. lata. *Umbellæ* 40–50-floræ, 2 poll. diam., spathæ valvis membranaceis rubellis cuspidatis 5–6 lin. longis, pedicellis strictis rubellis demum 6–9 lin. longis. *Perianthium* campanulato-cylindricum 4½ lin. longum, segmentis lanceolatis acuminatis pallidis costa saturate rubella percursis. *Stamina* perianthio distincte breviora, filamentis basi in cupulam coalitis et cum perianthio adnatis. *Ovarium* oblongum, stylo ovario æquilongo.

Flores *A. tatarici*, Linn. f., folia *A. senescentis*, Linn.

Badghis : 384, May 3, 20, 1885. Native name *Sir-piaz-ak*. In large quantities, though local, in the Badghis. The natives look upon this as wild garlic, and its abominable odour probably proves its right to a relationship.

MUSCARI RACEMOSUM, Mill. ; Boiss. Fl. Or. v. p. 295.

Badghis : 117, March 7, 12, 19, 1885, May 22, 1885. Common throughout the Badghis, in loamy soil ; flowering in early spring.

HYACINTHUS CILIATUS, Cyr.—*Bellevalia ciliata*, Boiss. Fl. Or. v. p. 302.

Badghis : 135, March 23, 1885 ; Hari-rud valley : April 12, 1885. Not common ; a plant here and there in clayey and loamy soil. Flowers inconspicuous, of a grey-blue colour.

FRITILLARIA KARELINI, Baker in Journ. Linn. Soc. xiv. p. 268 ; Boiss. Fl. Or. v. p. 188.

Badghis : 137, March 19, 1885 ; Hari-rud valley : April 3, 7, 1885. Extremely common in sandy soil. A very handsome species when in good flower ; but it may have from only one to twenty flowers on a stem.

TULIPA MONTANA, Lindl.; Boiss. Fl. Or. v. p. 192.

Hari-rud valley: 151, April 2; 193, April 7, 3, 11, 21, 1885. Native names: *Lala, Lale*; bulbs, *Gol-i-Lale.* In early spring the plains between Chashma-sabz pass and Tirphul are coloured with this species, which varies from every shade of red to pure yellow, the base of the perianth always deep purple. The natives collect and eat the bulbs, which are rather nice in flavour.

TULIPA HUMILIS, Herb.; Boiss. Fl. Or. v. p. 199.

Badghis: 131, March 18, 19, 1885; Hari-rud valley: April 6, 7, 15, 1885. This small Tulip, very like an *Anemone*, was common everywhere in moist clayey soil, especially in localities where there had once been cultivation. Usually the scape is only one-flowered, but not unfrequently it is two- or even three-flowered.

GAGEA CHLORANTHA, Roem. & Schult.; Boiss. Fl. Or. v. p. 209.

Hari-rud valley: 1130, April 15, 1885. Common in sandy soil, bordering the beds of streams.

GAGEA AMBLYOPETALA, Boiss. et Heldr.; Boiss. Fl. Or. v. p. 206.

Badghis: 116, March 7, 18, 1885. The sandy soil in many localities is consolidated by this minute plant into a turf.

GAGEA PERSICA, Boiss. Fl. Or. v. p. 210.

Badghis: 1131, April 1, 1885. Common on the low hills of the Badghis.

GAGEA RETICULATA, Roem. & Schult.; Boiss. Fl. Or. v. p. 208.

Badghis: 127, March 15, 1885; 136, March 19, 1885; Hari-rud valley: April 6, 1885. In sandy soil; common.

COLCHICUM SPECIOSUM, Stev.; Boiss. Fl. Or. v. p. 159.

Khorasan: 1132, June 17, 18, 1885. Occasional throughout the Badghis, Hari-rud valley, and Khorasan.

MERENDERA SOBOLIFERA, C. A. Mey.; Boiss. Fl. Or. v. p. 167.

Badghis: 112, February 14, 1885. Abundant in wet clayey meadow-land, creeping amongst the roots of grassy turf. In bright sunshine during winter, when the sun is melting the snow, the flowers appear like stars on the surface of the withered turf.

MERENDERA PERSICA, Boiss. Fl. Or. v. p. 169; Aitch. in Trans. Pharm. Soc. ser. iii. xvii. 1887, p. 468.

Badghis: 113, February 17, 1885; Hari-rud valley: April 12, 1885. On low sand-hills, very common. Flowers pale pink to pure snow-white, usually several in a cluster. The corms are collected and employed in native medicine under the name of *Shambalit.*

JUNCACEÆ.

JUNCUS GLAUCUS, Ehrh.; Boiss. Fl. Or. v. p. 353.

Khorasan: 662, June 17, 1885. At an altitude of 5000 feet, near running water.

JUNCUS MARITIMUS, Linn.; Boiss. Fl. Or. v. p. 354.

Northern Baluchistan: 62, October 1884; Hari-rud valley: August 18, 1885. Native name *Chab.* Common in beds of streams.

JUNCUS ACUTIFLORUS, Ehrh.; Boiss. Fl. Or. v. p. 358.

Khorasan: 663, June 17, 1885. On the banks of streams at an altitude of 5000 feet.

JUNCUS LAMPOCARPUS, Ehrh.; Boiss. Fl. Or. v. p. 358.

Hari-rud valley: 777, August 18, 1885. Common, near water, forming a turf.

JUNCUS GERARDI, Loisel, var. **CONDENSATUS**, Boiss. Fl. Or. v. p. 356.

Badghis: 523 (2nd), May 20, 1885; Paropamisus range: 557, May 24, 1885. In moist meadow-land, at an altitude of 4000 feet.

PALMÆ.

PHŒNIX DACTYLIFERA, Linn.; Boiss. Fl. Or. v. p. 47.

Northern Baluchistan. Native name for the Palm *Mach*; for the fruit *Khurma*. In our march through Baluchistan we occasionally encountered specimens of the Date Palm, as at Nushki, Koh-haja, &c. The most northern locality where it was seen was Zagin in the Harut basin; here was one good specimen; three others close to it had lately been killed, I supposed by the frost, as their stems were still standing *.

TYPHACEÆ.

TYPHA ANGUSTATA, Bory & Chaub.; Boiss. Fl. Or. v. p. 50.

Khorasan: 803, August 25, 1885. Native name *Luhk*. In still water. This species is apt to bear male and female flowers on different plants, and is thus pseudo-diœcious.

TYPHA, sp.

Locality and date of collecting unknown: 1133. Fruiting-spikes only.

AROIDEÆ.

ARUM GRIFFITHII, Schott; Boiss. Fl. Or. v. p. 38.

The specimens collected during this expedition are much larger than those collected in 1879 in the Kuram valley, the spathe being longer, the spadix longer and stouter; but these differences appear merely due to a more luxuriant growth.

Badghis: 354, May 1, 18, 1885. At the roots of bushes and amongst large stones; common. This is a favourite food of the wild hog.

HELICOPHYLLUM CRASSIFOLIUM, Engl. in DC. Monogr. Phanerog. vol. ii. p. 597 (excl. syn. *Biarum Lehmanni*, Bunge).

"I have not seen an authentic specimen of this species; but to judge from the descriptions given, and by Schott's figure of the plant, there seems no reason to doubt that the beautiful specimens collected by Dr. Aitchison are referable here; they differ only in having the leaves somewhat narrower, and less hastate at the base, than is represented by Schott; in other respects they quite agree with the figure. The crispulate edges of the leaves are blackish purple."—*N. E. Brown.*

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* I should mention here that the seed figured (Journ. Linn. Soc. xix. pl. 26. figs. 9-12) as that of *Nannorhops Ritchieana* does not belong to that Palm, and there is some doubt as to what it is.

Hari-rud valley: 164, April 7, 1885. Native name *Phanar*. In the gravelly plains, between the Paropamisus range and the Hari-rud river in great abundance, and very conspicuous from its splendid deep-purple-coloured spathe.

CYPERACEÆ*.

CYPERUS GLABER, Linn.; Boiss. Fl. Or. v. p. 371.

Hari-rud valley: 775, August 18, 1885. Near running water; common.

CYPERUS LÆVIGATUS, Linn.; var. ALBIDUS, Boeck.; Boiss. Fl. Or. v. p. 366.

Hari-rud valley: 778, August 18, 1885.

CYPERUS LONGUS, Linn. var.; Boiss. Fl. Or. v. p. 375.—Forma *microstachya*.

Khorasan: 624, June 14, 1885.

CYPERUS ROTUNDUS, Linn.; Boiss. Fl. Or. v. p. 376.

Helmand: 85, October 25, 1884; Khorasan: August 27, 1885. In cultivated ground; very common.

CYPERUS PUNGENS, Boeck.—*Cyperus conglomeratus*, Rottb.; Boiss. Fl. Or. v. p. 369.

Northern Baluchistan: 36, October 4, 1884. In deep pure sand it develops curious spongy rootlets exactly like those of *Aristida plumosa* when in the same soil.

ELEOCHARIS PALUSTRIS, R. Br.; Boiss. Fl. Or. v. p. 386.

Hari-rud valley: 446, May 11, 1885. Near water, abundant.

SCIRPUS LACUSTRIS, Linn.; Boiss. Fl. Or. v. p. 383.

Khorasan: 689, June 18, 19, 1885. In deep, still water; common.

SCIRPUS MARITIMUS, Linn.; Boiss. Fl. Or. v. p. 384 (varietates).

Hari-rud valley: 776, August 18, 1885. Forming a turf on the sides of streams. Khorasan: 788, August 21, 1885. Common on the edges of streams and irrigation-channels.

SCIRPUS HOLOSCHŒNUS, Linn.; Boiss. Fl. Or. v. p. 381.

Khorasan: 660, June 17, 1885; Hari-rud valley: August 3, 5, 18, 1885. Extremely common and conspicuous over the whole country, by the side of running water, at altitudes above 3000 feet.

CAREX PHYSODES, Bieb.; Boiss. Fl. Or. v. p. 399.

Hari-rud valley: 1134 *c*, *d*, *e*, April 6, 10, 18, 21, 1885. Forms a turf in many localities, especially in the Badghis. Very striking, from its large, chocolate-coloured, inflated utricles.

CAREX STENOPHYLLA, Wahlb.; Boiss. Fl. Or. v. p. 400.

Badghis: 138 *a*, *b*, March 19, 1885, May 4, 1885. Forms, with *Carex physodes*, the turf of the Gulran meadows. This species was much affected by a fungus.

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* I am indebted to Dr. O. Boeckeler for the determination of the species of this order.

Carex divisa, Huds.; Boiss. Fl. Or. v. p. 401.

Badghis: 523, May 20, 1885; Paropamisus range: 558, May 24, 1885; Khorasan: 661, June 17, 1885. In meadows, at an altitude above 3000 feet.

Carex punctata, Gaud., var. *utriculis impunctatis*, Boeck.; Boiss. Fl. Or. v. p. 427.

Badghis: 535, May 22, 1885; Paropamisus range: May 25, 1885. On the sides of streams, at an altitude above 4000 feet.

GRAMINEÆ.

Panicum miliaceum, Linn.; Boiss. Fl. Or. v. p. 441.

A cultivated grain in the Badghis: 1135. It is also extensively cultivated in India.

Panicum cruciforme, Sibth. & Smith; Boiss. Fl. Or. v. p. 437.

Khorasan: 794, August 23, 1885. On the sides of irrigation-channels; common.

Panicum Crus-Galli, Linn.; Boiss. Fl. Or. v. p. 435.

Khorasan: 814, August 29, 1885. In running water; common and vigorous.

Panicum antidotale, Retz., var.; Boiss. Fl. Or. v. p. 440.—Var. *spiculis majoribus* fide Munro.

Helmand: 82, October 25, 1885. In flooded clay-lands, forming meadows. On the rhizomes are nodules from one to two inches in length and half an inch thick, and covered densely with short silky hairs.

Setaria viridis, Beauv.; Boiss. Fl. Or. v. p. 443.—Syn. *Panicum viride*, Linn.

Khorasan: 1136, August 23, 1885.

Pennisetum dichotomum, Del.; Boiss. Fl. Or. v. p. 444.

Northern Baluchistan: 40, October 6, 8, 1884. Native name *Barshonk*. In the desert, in stony ground and amongst rocks, not in sand. Collected largely for fodder, and one of the most valuable of the desert plants. It grows here very differently from what it does as usually met with in the Punjab. Its stems are often three to four feet high, and resemble miniature bamboos; our horses, however, relished it.

Pennisetum spicatum, Del.—*Penicillaria spicata*, Willd.—*Pennisetum typhoideum*, Rich.; Boiss. Fl. Or. v. p. 447.

Occasionally seen cultivated in Khorasan. The *Bajza* of the Punjab.

Erianthus Ravennæ, Beauv.; Boiss. Fl. Or. v. p. 454.

Northern Baluchistan: 64, October 11, 1884; Khorasan: 816, September 1, 1885. Native name in Baluchistan *Kash*; Afghanistan *Kandur*, *Munj*. In stream-beds, along with *Tamarix*, common. It grows in great tussocks and helps to form the thickets in the stream-beds, where the wild hog finds its cover.

Erianthus?

Khorasan: 795, August 23, 1885. Native name *Kalmi*. Cultivated in gardens, and employed in making pens.

ANDROPOGON LANIGER, Desf.; Boiss. Fl. Or. v. p. 465.

Northern Baluchistan: 59, October 11, 1884; Hari-rud valley: 762, August 4, 1885. Common in stony soil. Highly aromatic and lemon-scented.

SORGHUM VULGARE, Linn.

Khorasan: 800, August 23, 1885. Native names: *Iowur, Jowhri-Turkimani.* In the Badghis near Bala-morghab, cultivated extensively in fields; in Persia and the Hari-rud sparingly amongst other crops, as in melon- and tobacco-fields. There are white- and black-grained varieties.

PHALARIS MINOR, Retz.; Boiss. Fl. Or. v. p. 472.

Hari-rud valley: 220, April 13, 1885; Khorasan: June 21, 1885. Near irrigation and in cultivated land; common.

ALOPECURUS PRATENSIS, Linn.—*Alopecurus arundinaceus*, Poir.; Boiss. Fl. Or. v. p. 487.

Hari-rud valley: 316, April 25, 1885; Badghis: May 20, 1885. Forming turf in moist land and near irrigation-channels.

ARISTIDA PUNGENS, Desf.; Boiss. Fl. Or. v. p. 498.

Hari-rud valley: 756, August 1, 1885. On sand-hills, growing in the loose sand near Zindijan.

ARISTIDA PLUMOSA, Linn.; Boiss. Fl. Or. v. p. 495.

Northern Baluchistan: 11, 21, September 29, 1884; 29, October 3, 1884; Hari-rud valley; July 28, 29, 1885. Native name, in Baluchistan, *Mazj*. Common on the sand-hills of the desert and most characteristic of that country, growing in small bright green tufts, and most luxuriantly in localities where one would say nothing could possibly exist. In the pure sand it throws out long spongy rootlets an eighth of an inch thick, by means of which it seems to maintain a supply of moisture for itself. This is the chief fodder of the sheep that exist in these parts.

STIPA PENNATA, Linn.; Boiss. Fl. Or. v. p. 502 (varietates).

Hari-rud valley: 415, May 9, 1885; 1137, May 26, 1885, June 5, 1885. On the gravelly plains, at an altitude of 3000 feet; in great abundance between Kohtal-sangi and Dana-sanjiti. Khorasan: June 18, 1885. In the stony soil of the great gravelly plains, most characteristic; growing in large tufts.

ORYZOPSIS CÆRULESCENS, Benth. & Hook. f.—*Piptatherum cærulescens*, Desf.; Boiss. Fl. Or. v. p. 507.

Khorasan: 648, June 16, 1885. Near moisture, at an altitude above 5000 feet.

HELEOCHLOA SCHŒNOIDES, Host; Boiss. Fl. Or. v. p. 476.

Helmand: 86, October 25, 1884; Khorasan: 695, June 21, 1885. In wet clayey soil; common.

POLYPOGON MONSPELIENSE, Desf.; Boiss. Fl. Or. v. p. 520.

Northern Baluchistan: 63, October 11, 1884. In moist ground, near water.

POLYPOGON LITTORALE, Smith; Boiss. Fl. Or. v. p. 521.

Khorasan: 625, June 14, 1885. Native name *Ki-ak.* In cultivated ground, and along the banks of irrigation-channels. It is considered a good fodder-grass.

CALAMOGROSTIS NEPALENSIS, Nees; Steudel, Syn. Glum., Gram. p. 193. no. 82.

Badghis: 536, May 22, 1885. Growing in clayey soil, covered with two or three inches of water, and in habit like an *Arundinaria.*

AVENA FATUA, Linn.; Boiss. Fl. Or. v. p. 540.

Hari-rud valley: 221, April 13, 1885, May 11, 1885. Common in cultivated land, growing amongst wheat and barley.

ARRHENATHERUM KOTSCHYI, Boiss. Fl. Or. v. p. 550.

Khorasan: 651, June 16, 1885. In moist soil, near water, at an altitude of 5000 feet.

CYNODON DACTYLON, Pers.; Boiss. Fl. Or. v. p. 553.

Khorasan: 698, June 21, 1885. A rare grass in these districts.

BOISSIERA BROMOIDES, Hochst.; Boiss. Fl. Or. v. p. 560.

Badghis: 364, May 1, 1885; Hari-rud valley: May 9, 1885; Khorasan: June 30, 1885. A common grass.

ARUNDO DONAX, Linn.; Boiss. Fl. Or. v. p. 564.

Helmand: 1138, October 21, 25, 1884. Native name *Nal.* Growing in and near water in great masses.

PHRAGMITES COMMUNIS, Trin.; Boiss. Fl. Or. v. p. 563.

Hari-rud valley: 766, August 5, 1885. Everywhere on the margins of irrigation-channels and in wet ground. Collected largely for fodder.

PHRAGMITES COMMUNIS, Trin., var. *foliis pungentibus.*

Northern Baluchistan: 1139, October 12, 1884; Hari-rud valley: July 29, 1885. In saline soil, with harsh, needle-pointed leaves.

ERAGROSTIS POÆOIDES, Beauv.; Boiss. Fl. Or. v. p. 580.

Helmand: 84 (2), October 25, 1884. In cultivated wet clayey soil.

ERAGROSTIS CYNOSUROIDES, Beauv.; Boiss. Fl. Or. v. p. 583.

Northern Baluchistan: 39, October 6, 1884; Helmand: 68, October 20, 1884. Native names: *Kir-thag, Drab.* In loose sandy soil in the desert, growing in great tussocks. It is considered good fodder.

ERAGROSTIS CYNOSUROIDES, Beauv., var. PAUCIFLORA.

Northern Baluchistan: 1140, October 6, 1884. A reduced form, collected with the type.

MELICA CILIATA, Linn.; Boiss. Fl. Or. v. p. 589.

Badghis: 487, May 17, 1885. In great clumps in clefts of rocks, where there is some moisture, at an altitude of 3000 feet.

ÆLUROPUS LITTORALIS, Parl.; Boiss. Fl. Or. v. p. 594.

Hari-rud valley: 605 (2), June 5, 1885, July 29, 1885. Native name *Khan-dar.* Very common, especially in saline soil. In habit it is like *Cynodon Dactylon,* and often mistaken for it.

ÆLUROPUS LITTORALIS, Parl., var. β. REPENS, Coss.; Boiss. Fl. Or. v. p. 594.

Helmand: 1141, October 25, 1884.

Another species of *Æluropus* was collected. It appears to be the same as an Afghan plant to which Munro gave a manuscript name.

Northern Baluchistan, where it was common.

SCHISMUS ARABICUS, Nees; Boiss. Fl. Or. v. p. 597.

Hari-rud valley: 295, April 21, 1885. In wet, clayey soil, on the islands in the river.

POA BULBOSA, Linn.; Boiss. Fl. Or. v. p. 605.

Hari-rud valley: 208, 330, April 12, 13, 27, 28, 1885; Badghis: April 29, 1885. Native name *Siah-li-weh.* In great luxuriance all over the plains of the country, especially near the Kambao pass and that region; highly valued as fodder.

POA TRIVIALIS, Linn.; Boiss. Fl. Or. v. p. 602.

Badghis: 542, May 22, 1885. In moist land, near water; abundant.

POA SOONGARICA, Boiss. Fl. Or. v. p. 611.

Paropamisus range: 563, May 25, 1885. In moist soil, at an altitude of 4500 feet.

FESTUCA OVINA, Linn.; Boiss. Fl. Or. v. p. 617.

Khorasan: 677, June 18, 1885. Forming extensive meadows, at an altitude exceeding 5000 feet.

FESTUCA MYURUS, Linn.; Steudel, Syn. Glum., Gram. p. 303. no. 22.

Paropamisus range: 559, 539 (2), May 24, 1885. Abundant, though local, at 4000 feet altitude.

BROMUS TECTORUM, Linn.; Boiss. Fl. Or. v. p. 647.

Hari-rud valley: 266, April 17, 18, 1885; Badghis: 1142, May 4, 1885. Inhabiting shady places in the early part of the season; common.

BROMUS CRINITUS, Boiss. et Hohenh.—*Bromus gracillimus,* Bunge; Boiss. Fl. Or. v. p. 647.

Hari-rud valley: 570, May 26, 1885.

BROMUS DANTHONIÆ, Trin.—*Bromus macrostachys,* Desf., var. γ. *triaristatus,* Hackel; Boiss. Fl. Or. v. p. 652.

Hari-rud valley: 439, May 11, 13, 1885. Common on dry gravelly soil. Awns deep purple.

Bromus commutatus, Schrad.; Boiss. Fl. Or. v. p. 654.
Badghis: 1143, May 1, 1885.

Lolium persicum, Boiss. et Hohenh.; Boiss. Fl. Or. v. p. 680.
Badghis: 502, May 18, 1885. Inhabiting meadow-land near water, in the shade of rocks and bushes; common.

Lolium perenne, Linn.; Boiss. Fl. Or. v. p. 679.
Hari-rud valley: 1144, June 3, 1885. In cultivated soil, on edges of fields, &c.; common.

Agropyrum Aucheri, Boiss. Fl. Or. v. p. 664.
Badghis: 547, May 23, 1885; Khorasan, June 15, 1885. Forming extensive meadows, but local, and not intermixed with other grasses. This is a late grass, following *Poa bulbosa* and *Bromus* as a second crop.

Agropyrum repens, Beauv.; Boiss. Fl. Or. v. p. 663.
Khorasan: 1145, June 16, 17, 21, 1885. Common at altitudes above 5000 feet.

Agropyrum piliferum, Benth.—*Heteranthelium piliferum*, Hochst.; Boiss. Fl. Or. v. p. 672.
Badghis: 490, May 17, 1885.

Agropyrum cristatum, Boiss. Fl. Or. v. p. 667.
Hari-rud valley: 311, April 25, 1885, May 9, 1885. Common over the whole plains. This, with *Agropyrum Aucheri*, forms a second crop of grass during the season. The variety collected here is only from six to eight inches in height, with numerous spreading stems from the roots, and it is quite glabrous. Badghis: 511, May 19, 20, 25, 1885. Characteristic of the Badghis, at an altitude of 2500 feet, forming immense stretches of pasture on loamy soil. It grows in great clumps, each perennial root producing numerous annual, erect stems, 18 inches to two feet in height, with the inflorescence much longer than in the type.

Agropyrum prostratum, Eichw.; Boiss. Fl. Or. v. p. 667.
Hari-rud valley: 196, April 7, 1885.

Secale cereale, Linn.; Boiss. Fl. Or. v. p. 671.
Hari-rud valley: 442, May 11, 1885. Native names: *Gandam-dar*, *Jow-thak-thak*; the Ergot, *Siah-khak*. A weed amongst wheat, in some fields in such quantity that there is as much rye as wheat. It is considered very hurtful to the system when a large amount of it is mixed with wheat-flour. Perfectly wild, and not grown anywhere as a distinct crop.

Triticum vulgare, Linn.
Hari-rud valley: 443, May 11, 1885, June 3, 1885. Native name *Gandam*. Extensively cultivated, though requiring irrigation at altitudes under 3000 feet; above that altitude irrigation is not a necessity. All the wheat I saw was of poor quality.

TRITICUM TRIUNCIALE, Aitch. & Hemsl.—*Ægilops triuncialis,* Linn.; Boiss. Fl. Or. v. p. 674.

Badghis: 495, May 18, 20, 1885. In shady localities, common.

TRITICUM CRASSUM, Aitch. & Hemsl.—*Ægilops crassa,* Boiss. Fl. Or. v. p. 677.

Badghis: May 14, 1885.

TRITICUM SQUARROSUM, Roth.—*Ægilops squarrosa,* Linn.; Boiss. Fl. Or. v. p. 676.

Badghis: 1146, 461 (2), May 14, 16, 1885. Very common in the shade of shrubs.

TRITICUM PERSICUM, Aitch. & Hemsl.—*Ægilops persica,* Boiss. Fl. Or. v. p. 675.

Hari-rud valley: 1147, June 4, 1885. In gravelly soil; common.

LEPTURUS PERSICUS, Boiss. Fl. Or. v. p. 685.

Hari-rud valley: 409, May 9, 10, 1885.

HORDEUM CAPUT-MEDUSÆ, Benth. & Hook. f.—*Elymus Caput-Medusæ,* Linn.; Boiss. Fl. Or. v. p. 691.

Badghis: 473, May 16, 1885. In great abundance, on the downs of the Badghis, growing over two feet in height.

HORDEUM MURINUM, Linn.; Boiss. Fl. Or. v. p. 686.

Hari-rud valley: 224, April 13, 21, 1885. In cultivated land, and along the banks of irrigation-channels; common.

HORDEUM ITHABURENSE, Boiss. Fl. Or. v. p. 686.

Badghis: 359, May 1, 1885; 465, May 14, 21, 1885. Very characteristic of the rolling downs of the Badghis, growing in great clumps up to 3 feet in height. In habit it resembles cultivated barley.

HORDEUM VULGARE, Linn.

Khorasan: 1148, June 17, 1885. Native names: *Jao-tursh, Jao.* Barley is largely cultivated in the Hari-rud valley, Badghis, and Khorasan, with irrigation below 3000 feet altitude; above this altitude it can be grown without it. It is said to take only three months to ripen, and is therefore sometimes raised as a second crop.

HORDEUM HEXASTICHUM, Linn.

Hari-rud valley: 585, June 3, 1885; 586, June 3, 1885. Native name *Jao-shirin.* Extensively cultivated, and furnishing the barley that is chiefly used as food by the people. *H. vulgare* is used as fodder for their horses. This takes fully four months to ripen, and hence can never be raised as a second crop.

EQUISETACEÆ.

EQUISETUM ELONGATUM, Willd.—*Equisetum ramosissimum,* Desf.—*Equisetum ramosum,* Schl.; Boiss. Fl. Or. v. p. 742.

Hari-rud valley: 757, August 1, 1885. On the banks of the Hari-rud, common.

FILICES.

Cheilanthes Szovitzii, Fisch. et Mey.; Boiss. Fl. Or. v. p. 726.

Khorasan; 653, June 16, 1885. In the clefts of limestone rocks on the hills south of Bezd, at an altitude above 5000 feet; the only locality where it was seen.

Adiantum Capillus-Veneris, Linn.; Boiss. Fl. Or. v. p. 730.

Badghis, near Sim-koh: 496, May 18, 1885. On wet rocks below a waterfall, at an altitude of 3000 feet. The only Fern met with in North-west Afghanistan.

CHARACEÆ.

Chara fœtida, A. Br. in Ann. Sc. Nat. 2^{me} série, i. p. 354, et in Flora, i. p. 63.

Badghis: 107, December 8, 1884. Plentiful in still water and pools of streams.

FUNGI.

Agaricus (Armillaria) rhizopus, Cooke, Grevillea, xiv. p. 89.

Hari-rud valley: 167, April 16, 1885.

Agaricus (Pleurotus) fossulatus, Cooke.

Badghis: 115, March 5, 1885.

"*A.* pileo carnoso, compacto, subdimidiato, areolato-diffracto, ochraceo-albo, glabro; stipite laterali, curvato, deorsum attenuato, longitudinaliter sulcato, subcrasso, solido, lamellis longe decurrentibus, sublatis, distantibus albis."—*M. C. Cooke.*

Pileus 2–3 in. broad, stem $1\frac{1}{2}$–2 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. thick.

Agaricus (Naucoria) Vervacti, Fries, Hym. Eur. p. 260.

Hari-rud valley: 270, April 18, 1885. In great masses, on the wet clayey soil left as a fresh deposit on islands on the receding of the river.

Agaricus (Psalliota) campestris, Linn.; Fries, Hym. Eur. p. 279.

Hari-rud valley: 171, April 6, 1885.

Agaricus (Stropharia) obturatus, Fries, Hym. Eur. p. 285.

Hari-rud valley: April 18, 1885. Collected along with No. 270, *A. Vervacti*, Fries.

Bolbitius mitræformis, Harv.; Hook. Journ. Bot. iii. (1844), p. 186, t. vi. B.

Badghis: 141, 173, March 24, 1885. This is a South-African and Australian species.

Polyporus fomentarius, Fries, Hym. Eur. p. 558.

Khorasan: 51, June 19, 1885.

Podaxon calyptratus, Fries, Syst. Myc. iii. p. 63.

Hari-rud valley: 165, April 6, 1885. Is common at the Cape and in India.

Xylopodium Aitchisoni, Cooke et Massee, Grevillea, xvi. p. 69. *X.* peridio clavato dein pyriformi, deorsum in stipitem rigidum attenuato, stipite æquali vel basim leniter bulboso, longitudinaliter sulcato-striato, squamuloso, solido. Sporis læte ochraceo-fuscis, globosis, asperulis 6–7 μ diam.

Hari-rud valley and Badghis. During the whole summer on clayey soil, chiefly near the hillocks of white ants' nests, sometimes six inches in circumference.

Tulostoma Wightii, Berk. in Herb. Kew.

Hari-rud valley: 178, 181, 203, April 7, 11, 1885.

"Peridium globosum (½–1 unc.) albidum, ore submammoideo pertusum, stipite rigido æquali, longitudinaliter striato (1½–3 unc.) initio squamoso, sporis capillitioque aureo-testaceis."—*M. C. Cooke.*

Geaster striatus, var. **minor**, Fries, Syst. Myc. iii. p. 14.

Hari-rud valley: 180, April 7, 1885.

Ustilago urceolorum, Tul. in Ann. Sc. Nat. 3^{me} série, vii. p. 86, t. 4. f. 7–10.

Badghis: March 19, 1885. Affects the utricles of *Carex stenophylla*, which become like blue-black beads.

DESCRIPTION OF THE PLATES.

[Where not otherwise indicated the plants, or portions of plants, are represented natural size.]

Plate I.

Ranunculus leptorrhynchus, Aitch. et Hemsl.

Fig. 1. Outside view of sepal, enlarged.
2. Inside view of sepal, enlarged.
3. A petal, enlarged.
4. A young carpel, enlarged.
5. Section of a nearly ripe carpel, enlarged.

Plate II.

Nigella integrifolia, Regel.

Fig. 1. A flower with involucre, enlarged.
2. One bract of the involucre, enlarged.
3. A sepal, enlarged.
4. A petal, enlarged.
5. Front and back views of a stamen, enlarged.
6. Ripe follicles dehiscing, enlarged.
7. A seed, enlarged.

Plate III.

Delphinium Zalil, Aitch. et Hemsl.

Fig. 1. Branchlet bearing ripe fruit, natural size.
2. Spurred sepal, natural size.
3. An anterior sepal, natural size.

Fig. 4. A lateral sepal, natural size.
5. A spurred petal, enlarged.
6. An anterior petal, enlarged.
7 and 8. Stamens, enlarged.
9. Pistil, enlarged.
10. Ripe fruit, enlarged.
11. A follicle dehiscing, enlarged.
12. A seed, enlarged.

PLATE IV.

Crambe cordifolia, Stev.

Fig. 1. A flower, enlarged.
2. A petal, enlarged.
3. Andrœcium and gynæcium, enlarged.
4. Pistil, enlarged.
5. Ripe pod, one valve removed, enlarged.
6. Embryo, enlarged.
7. Section of the same, enlarged.

PLATE V.

Figs. 1–10. *Ruta affinis*, Aitch. et Hemsl.

Fig. 1. Portion of a plant, natural size.
2. Branchlet bearing fruit, natural size.
3. Portion of a leaf, enlarged.
4. A flower, enlarged.
5. A petal, enlarged.
6. Stamens, enlarged.
7. Section of ovary, enlarged.
8. Fruit, enlarged.
9. A seed, enlarged.
10. Section of the same, enlarged.

Figs. 11–16. *Ruta rotundifolia*, Aitch. et Hemsl.

Fig. 11. A flowering branch.
12. Portion of a leaf, enlarged.
13. A flower, enlarged.
14. Stamens, enlarged.
15. Pistil, enlarged.
16. Section of ovary, enlarged.

PLATE VI.

Astragalus heratensis, Bunge.

Fig. 1. Sketch of habit of the plant.
2. A flowering branch.
3. A flower, enlarged.
4. Keel-petals, enlarged.
5 and 6. Wing-petals, enlarged.

Fig. 7. Standard petal, enlarged.
8. Young fruit, enlarged.
9. Section of the same, enlarged.
10. Section of another with aborted ovules.

PLATE VII.

Astragalus Lumsdenianus, Aitch. et Baker.

Fig. 1. A flower, enlarged.
2. Standard petal, enlarged.
3 and 4. Wing-petals, enlarged.
5. Keel-petals, enlarged.
6. Pistil, enlarged.
7. Section of ovary, enlarged.

PLATE VIII.

Prunus calycosus, Aitch. et Hemsl.

Fig. 1. A flowering branch, natural size.
2. A branch bearing young fruit, natural size.
3. A leaf with stipules attached, enlarged.
4. A partially expanded flower, enlarged.
5. A fully expanded flower, enlarged.
6. A sepal, enlarged.
7. A pistil, enlarged.
8. The same in section, enlarged.

PLATE IX.

Cotoneaster nummularia, Fisch. et Mey.

Fig. 1. Fruiting branch.
2. Flowering branch.
3. A flower, enlarged.
4. A petal, enlarged.
5. A fruit, enlarged.

PLATE X.

Bryonia monoica, Aitch. et Hemsl.

Fig. 1. A male flower, enlarged.
2. Anthers, enlarged.
3. A female flower, enlarged.
4. Pistil of the same, enlarged.

PLATE XI.

Trachydium Lehmannii, Benth. et Hook. f.

Fig. 1. A bract, enlarged.
2. A flower seen from below, enlarged.
3. A flower seen from above, enlarged.

Fig. 4. A petal, enlarged.
5. Fruit, enlarged.
6. Cross section of the same, enlarged.

PLATES XII. AND XIII.

Ferula fœtida, Regel.

Fig. 1. Stem reduced to one quarter of the natural size.
2. Portion of a radical leaf, natural size.
3. A branch of the inflorescence, consisting of a central female umbel and several male umbels, natural size.
4. A ripe fruit, enlarged.
5. A mericarp and carpophore, enlarged.
6. Section of a mericarp, enlarged.

PLATE XIV.

Ferula fœtida, Regel.

Fig. 1. A young plant with undeveloped inflorescence enveloped in the large bracts, much reduced.
2. A cauline leaf and portion of stem, natural size.
3. Portion of inflorescence, natural size.
4. A male flower, enlarged.
5. A female flower, enlarged.
6. A stamen, enlarged.
7. A pistil, enlarged.

PLATES XV. AND XVI.

Ferula galbaniflua, Boiss.

Fig. 1. A cauline leaf attached to portion of hollow stem, natural size.
2. Ripe fruit, enlarged.
3. Mericarp and carpophore, enlarged.
4. Dorsal view of mericarp, enlarged.
5. Cross section of mericarp, enlarged.

PLATE XVII.

Ferula galbaniflua, Boiss.

Fig. 1. Portion of a radical leaf, natural size.
2. Small portion of leaf, enlarged.
3. Portion of inflorescence, consisting of a central female umbel and two lateral male umbels, natural size.
4. A male flower, enlarged.
5. A petal from the outside, enlarged.
6. A petal from the inside, enlarged.
7. Young fruit, enlarged.

PLATE XVIII.

Ferula oopoda, Boiss.

Fig. 1. A plant, about one sixteenth natural size, drawn from Dr. Aitchison's sketch.
2. A cauline leaf, natural size.
3. A lateral inflorescence, from the axil of figure 2, consisting of a central female umbel, and three smaller male umbels springing from its base, natural size.
4. A male flower, enlarged.
5. A female flower, enlarged.
6. A petal, enlarged.
7. A pistil, enlarged.
8. Ripe fruit, natural size.
9. A mericarp, enlarged.
10. Inner face of the same, with a portion of the carpophore, enlarged.
11. Cross section of the same, enlarged.

PLATE XIX.

Ferula oopoda, Boiss.

Fig. 1. Lower portion of a small radical leaf, natural size.
2. Terminal portion of the same leaf.

PLATE XX.

Ferula suaveolens, Aitch. et Hemsl.

Fig. 1. A young plant, about one sixth of the natural size.
2. Portion of inflorescence, consisting of a central female umbel, and several lateral male umbels overtopping it, natural size.
3. A bract, enlarged.
4. A hermaphrodite flower, natural size.
5. A male flower, natural size.
6. A petal, natural size.
7. A very young fruit, natural size.

PLATE XXI.

Ferula suaveolens, Aitch. et Hemsl.

Fig. 1. An old stem, about one sixth natural size.
2. Portion of a young plant, natural size.
3. Terminal portion of a leaf, natural size.
4. Piece of leaf, much enlarged.

PLATE XXII.

Carum leptocladum, Aitch. et Hemsl.

Fig. 1. A plant, natural size.
2. A bract, enlarged.
3. A petal, enlarged.
4. Back view of same, enlarged.

Fig. 5. Young fruit, enlarged.
6. Ripe fruit, enlarged.
7. A mericarp and carpophore, enlarged.
8. Cross section of same, enlarged.

PLATES XXIII. AND XXIV.

Dorema Ammoniacum, D. Don.

Fig. 1. Old stem, reduced to one third of the natural size.
2. Portion of a leaf, natural size.
3. Portion of inflorescence, natural size.
4. A male flower, enlarged.
5. A female flower, enlarged. On account of the woolliness, the petals appear continuous with the calyx-tube.
6. A petal, enlarged.
7. A young fruit.

PLATE XXV.

Dorema Ammoniacum, D. Don.

Fig. 1. Inflorescence, reduced to one third of natural size.
2. Portion of a radical leaf, natural size.
3. Fruiting branch, natural size.
4. A fruit, enlarged.
5. A mericarp, enlarged.
6. Section of the same, enlarged.

PLATE XXVI.

Dorema glabrum, Fisch. et Mey.

Fig. 1. Portion of an old stem, about one eighth natural size.
2. Portion of infloresce, natural size.
3. A staminate flower, enlarged.
4. A petal, enlarged.
5. A pistil, enlarged.

PLATE XXVII.

Dorema glabrum, Fisch. et Mey.

Fig. 1. A radical leaf, one third natural size.
2. A portion of the same, natural size.
3. Fruit, natural size.
4. A mericarp, enlarged.
5. The same attached to the carpophore, enlarged.
6. Cross section of the same, enlarged.

PLATE XXVIII.

Dorema serratum, Aitch. et Hemsl.

Fig. 1. A radical leaf, natural size.
2. A cauline leaf, natural size.

Fig. 3. Branch bearing ripe fruit, natural size.
4. Portion of a leaf, enlarged.
5. A mericarp, enlarged.
6. The same attached to carpophore, enlarged.
7. Section of the same, enlarged.
8. Embryo, enlarged.

PLATE XXIX.

Johrenia platypoda. Aitch. et Hemsl.

Fig. 1. Portions of plant, natural size.
2. A young plant, enlarged.
3. A ripe fruit, enlarged.
4. A mericarp and carpophore, enlarged.
5. A cross section of the same, enlarged.

PLATE XXX.

Gaillonia dubia, Aitch. et Hemsl.

Fig. 1. A node with petioles and stipules, enlarged.
2. A corolla laid open, enlarged.
3. Pistil, enlarged.
4. Ripe fruit dehiscing into mericarps, enlarged.
5. Section of mericarp, showing attachment of seed, enlarged.
6. Section of seed, showing embryo, enlarged.

PLATES XXXI. AND XXXII.

Codonocephalum Peacockianum, Aitch. et Hemsl.

Fig. 1. A radical leaf, natural size.
2. Portion of inflorescence, natural size.
3. A capitulum, with the flowers and some of the bracts removed, showing the receptacle, enlarged.
4. Bracts of the involucre, enlarged.
5. A flower, enlarged.
6. A bristle of the pappus, enlarged.
7. Stamens, enlarged.
8. Part of style and stigma, enlarged.

PLATE XXXIII.

Anthemis caulescens, Aitch. et Hemsl.

Fig. 1. Portion of a leaf, enlarged.
2. An involucral bract, enlarged.
3. Chaff of the receptacle, enlarged.
4. A flower, enlarged.
5. Stamens, enlarged.
6. Part of style and stigma, enlarged.

PLATE XXXIV.

Jurinea variabilis, Aitch. et Hemsl.

Fig. 1. An involucral bract, enlarged.
2. Chaff of the receptacle, enlarged.
3. A flower, enlarged.
4. A plume of the pappus, enlarged.
5. Stamens, enlarged.
6. Part of style and stigma, enlarged.

PLATE XXXV.

Acantholimon speciosissimum, Aitch. et Hemsl.

Fig. 1. Portion of a leaf, enlarged.
2. A spikelet, enlarged.
3. A calyx, enlarged.
4. Pistil, enlarged.

PLATE XXXVI.

Acantholimon Ecæ, Aitch. et Hemsl.

Fig. 1. A leaf, enlarged.
2. A spikelet, enlarged.
3. A bract, enlarged.
4. A calyx, enlarged.
5. Stamens, enlarged.
6. Pistil, enlarged.

PLATE XXXVII.

Apocynum venetum, Linn.

Fig. 1. A leaf, enlarged.
2. A flower-bud, enlarged.
3. A corolla, laid open, enlarged.
4. Andrœcium and pistil, enlarged.
5. An anther, enlarged.
6. Pistil, enlarged.

PLATE XXXVIII.

Hyoscyamus Senecionis, Willd., var. *multifidus*, Aitch. et Hemsl.

Fig. 1. A flower, corolla removed, enlarged.
2. Stamens, enlarged.
3. Fruiting calyx, enlarged.
4. Capsule, enlarged.
5. Section of the same, enlarged.
6. Seeds, enlarged.

PLATE XXXIX.

Cistanche Ridgewayana, Aitch. et Hemsl.

Fig. 1. A bract, enlarged.
2. Calyx and pistil, enlarged.
3. Corolla, laid open, enlarged.
4. Ovary, enlarged.
5. Cross section of the same, enlarged.

Plate XL.

Cistanche laxiflora, Aitch. et Hemsl.

Fig. 1. Corolla laid open, enlarged.
2. Stamens, enlarged.
3. Pistil, enlarged.
4. Cross section of the ovary, enlarged.

Plate XLI.

Nepeta Sewerzowii, Regel.

Fig. 1. Portion of a leaf, enlarged.
2. A flower, enlarged.
3. Stamens, enlarged.
4. Pistil, enlarged.
5. Fruiting calyx, enlarged.
6. Ripe fruit, enlarged.
7. Interior face of a nutlet, enlarged.

Plate XLII.

Figs. 1–6. *Chamæsphacos persicus*, Aitch. et Hemsl.

Fig. 1. A plant, natural size.
2. A flower, enlarged.
3. Pistil, enlarged.
4. Fruit, enlarged.
5 & 6. Nutlets from different positions, enlarged.

Figs. 7–11. *Chamæsphacos afghanicus*, Aitch. et Hemsl.

Fig. 7. A plant, natural size.
8. A flower, enlarged.
9. Calyx, laid open, enlarged.
10. Stamina, enlarged.
11. Pistil, enlarged.

Figs. 12–18. *Chamæsphacos ilicifolius*, Schrenk.

Fig. 12. A plant, natural size.
13. A flower, enlarged.
14. Fruiting calyx, enlarged.
15. Ditto, attached, enlarged.
16. Pistil, enlarged.
17. Fruit, enlarged.
18. A nutlet, enlarged.

Plate XLIII.

Stachys trinervis, Aitch. et Hemsl.

Fig. 1. Portion of a leaf, enlarged.
2. Calyx, enlarged.
3. Stamens, enlarged.
4. Nutlets, enlarged.

PLATE XLIV.

Atriplex Moneta, Bunge.

Fig. 1. A male flower, enlarged.
2. A female flower, enlarged.
3. Fruit in section, enlarged.
4. Seed, enlarged.
5. Section of the same, enlarged.

PLATE XLV.

Rheum tataricum, Linn.

Fig. 1. Portion of a leaf, natural size.
2. Portion of inflorescence, natural size.
3. Branch bearing fruit, natural size.
4. A flower, enlarged.
5. Pistil, enlarged.
6. Achene, enlarged.
7. Section of the same, enlarged.
8. Embryo, enlarged.

PLATE XLVI.

Ficus Carica, Linn. ♂ and ♀.

Fig. 1. A leaf from a barren branch, natural size.
2. Section of a male receptacle, enlarged.
3. A male flower, enlarged.
4. A gall-flower, enlarged.
5. Pistil of a gall-flower, enlarged.
6. Pistil of a gall-flower containing larva, enlarged.
7. Section of a female receptacle, enlarged.
8. A female flower.
9. Achene.

PLATE XLVII.

A and B, figs. 1–10. *Ephedra pachyclada*, Boiss. ?

A. Portion of a male plant, natural size.
B. Portion of a female plant, natural size.
Fig. 1. Portion of a branch, enlarged.
2. Male inflorescence, enlarged.
3. A bract, enlarged.
4. A male flower, enlarged.
5. A female flower, enlarged.
6. A fruit, enlarged.
7. A fruit, bracts removed, enlarged.
8. A seed, enlarged.
9. Longitudinal section of same, enlarged.
10. Cross section of same, enlarged.

PLATE XLVII. (*continued*).

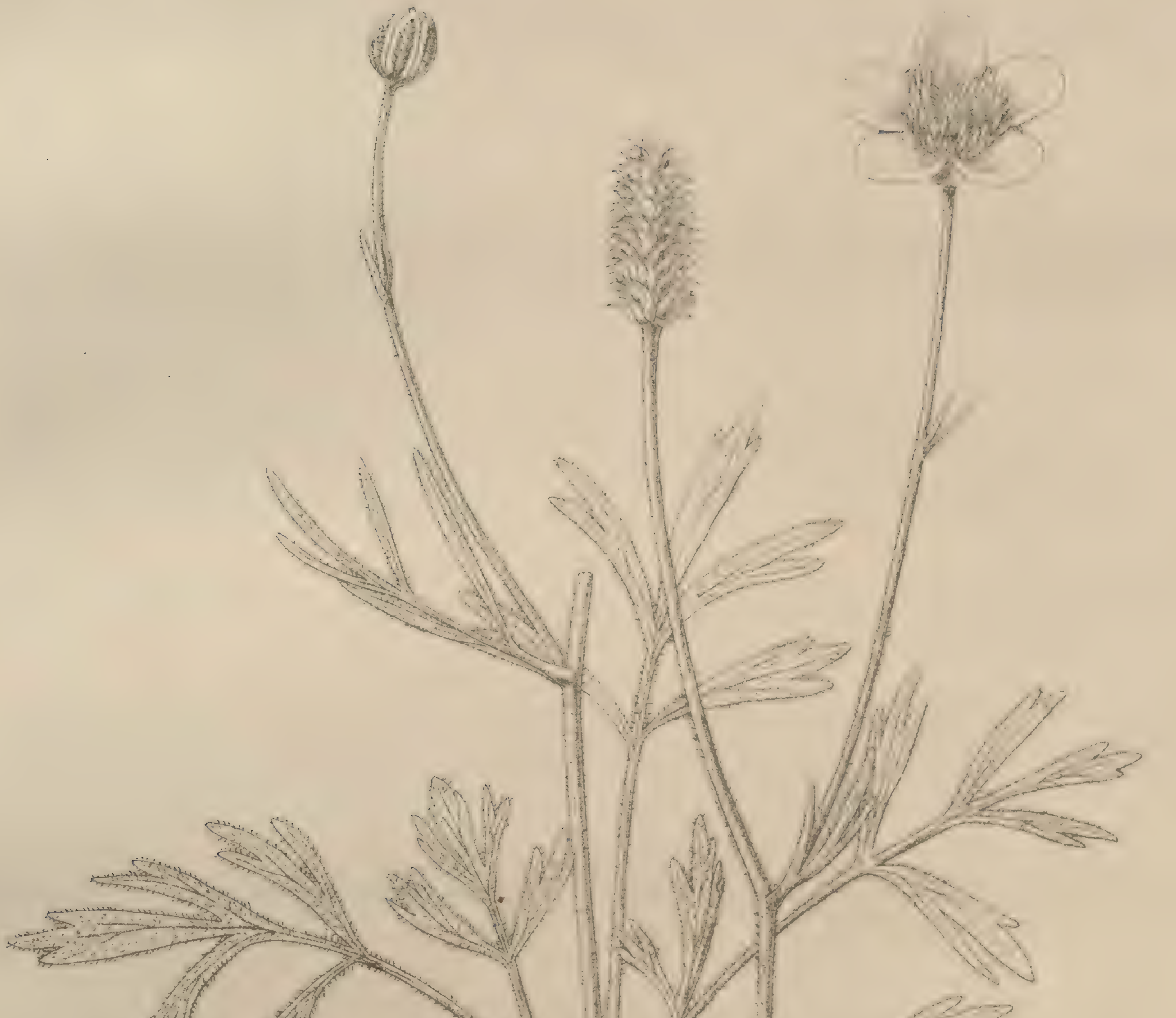
C, figs. 11–15. *Ephedra sarcocarpa*, Aitch. et Hemsl., ♀.

Fig. 11. Fleshy bract, enlarged.
12. Fruit, enlarged.
13. Seed, enlarged.
14. Longitudinal section of same, enlarged.
15. Cross section of same, enlarged.

PLATE XLVIII.

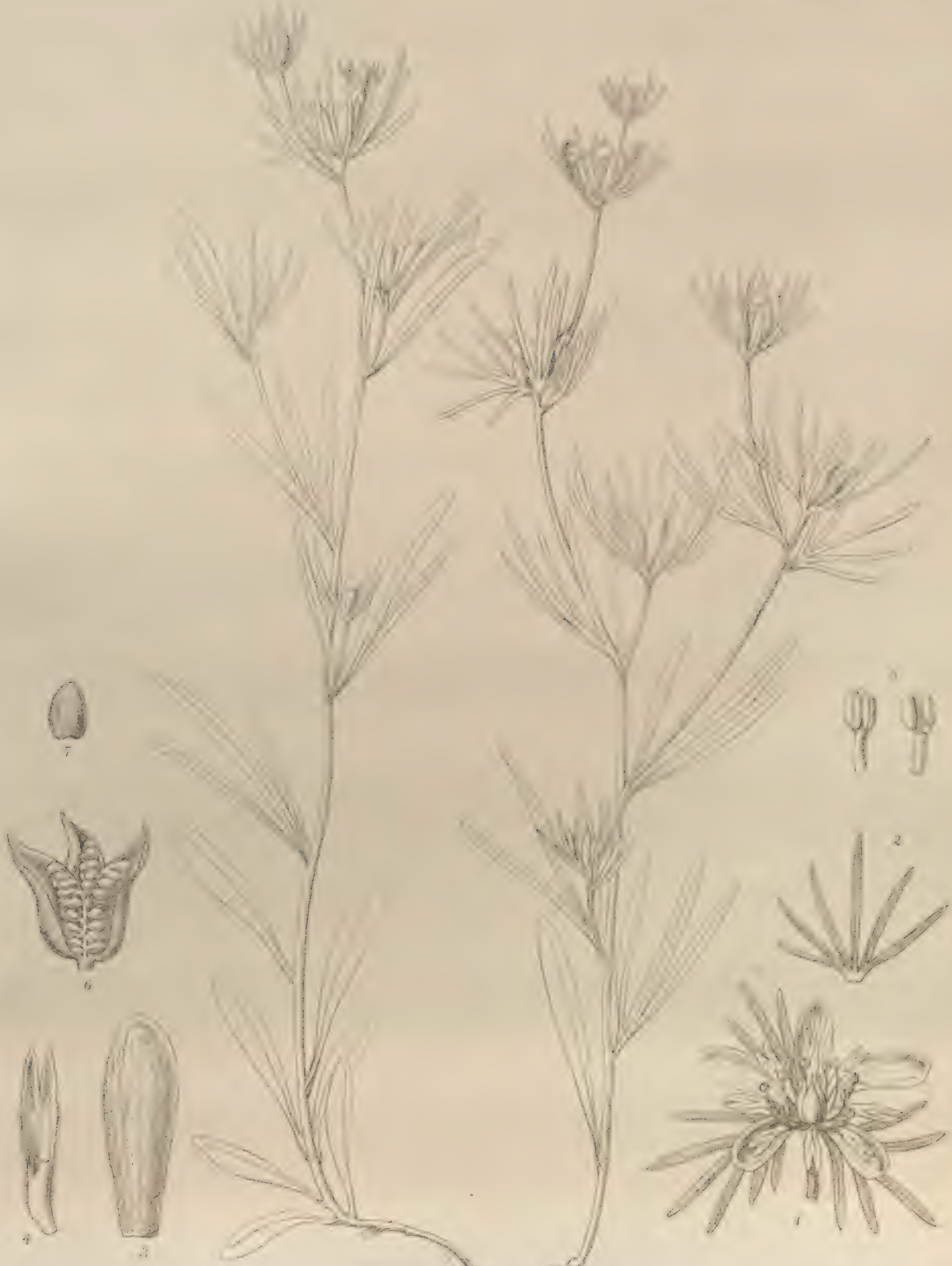
Allium xiphopetalum, Aitch. et Baker.

Fig. 1. A plant, natural size.
2. An inflorescence at a late stage, natural size.
3 and 4. Segments of perianth, enlarged.
5. Stamens, enlarged.
6. Pistil, enlarged.
7. The same in section, much more enlarged.



M. Smith del. J. Allen lith. W. B. Hemsley dir. Hanhart imp.

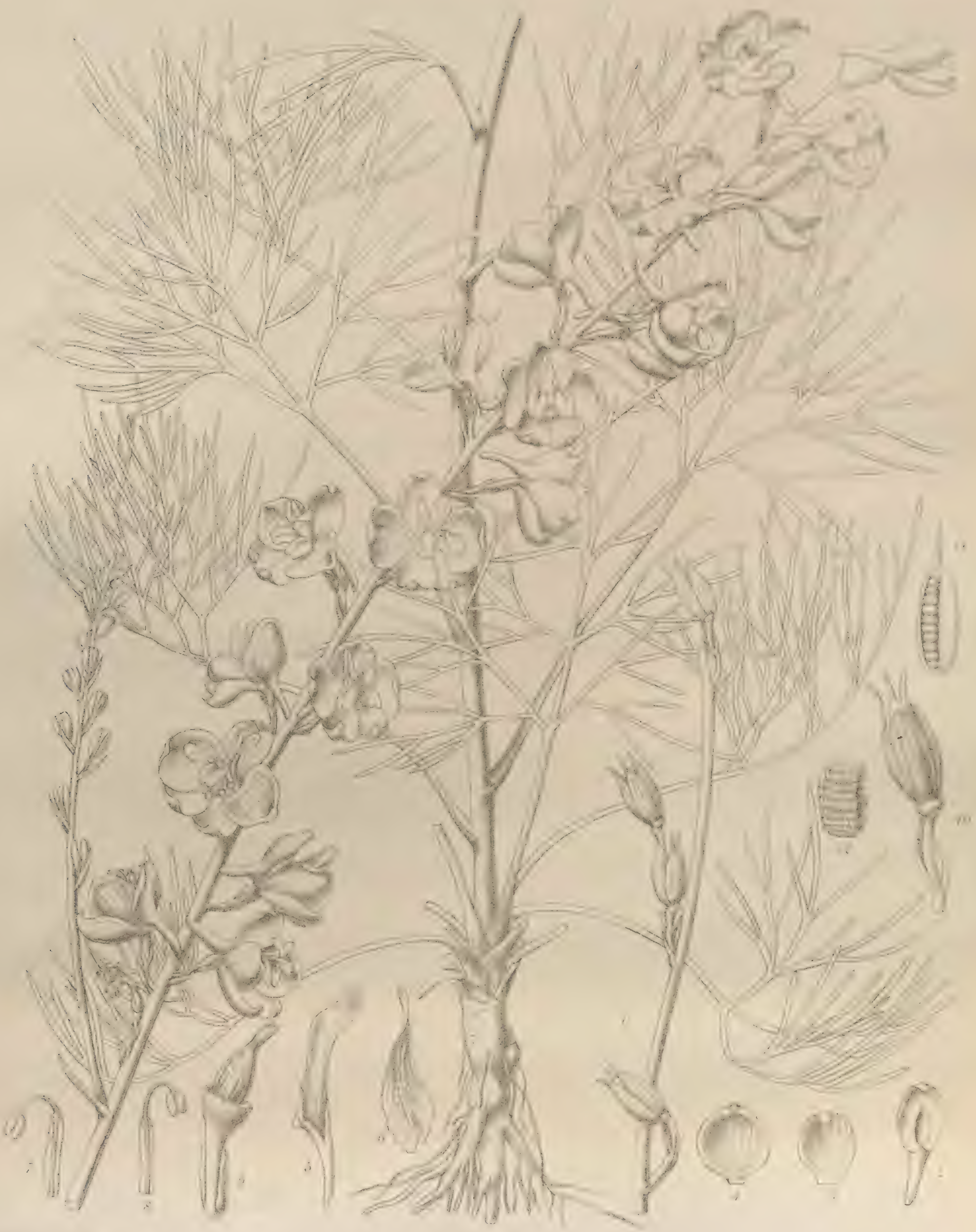
RANUNCULUS LEPTORRHYNCHUS, *Aitch. et Hemsl.*



M. Smith del. J. Allen lith.

W. B. Hemsley dir.

NIGELLA INTEGRIFOLIA *Regel.*

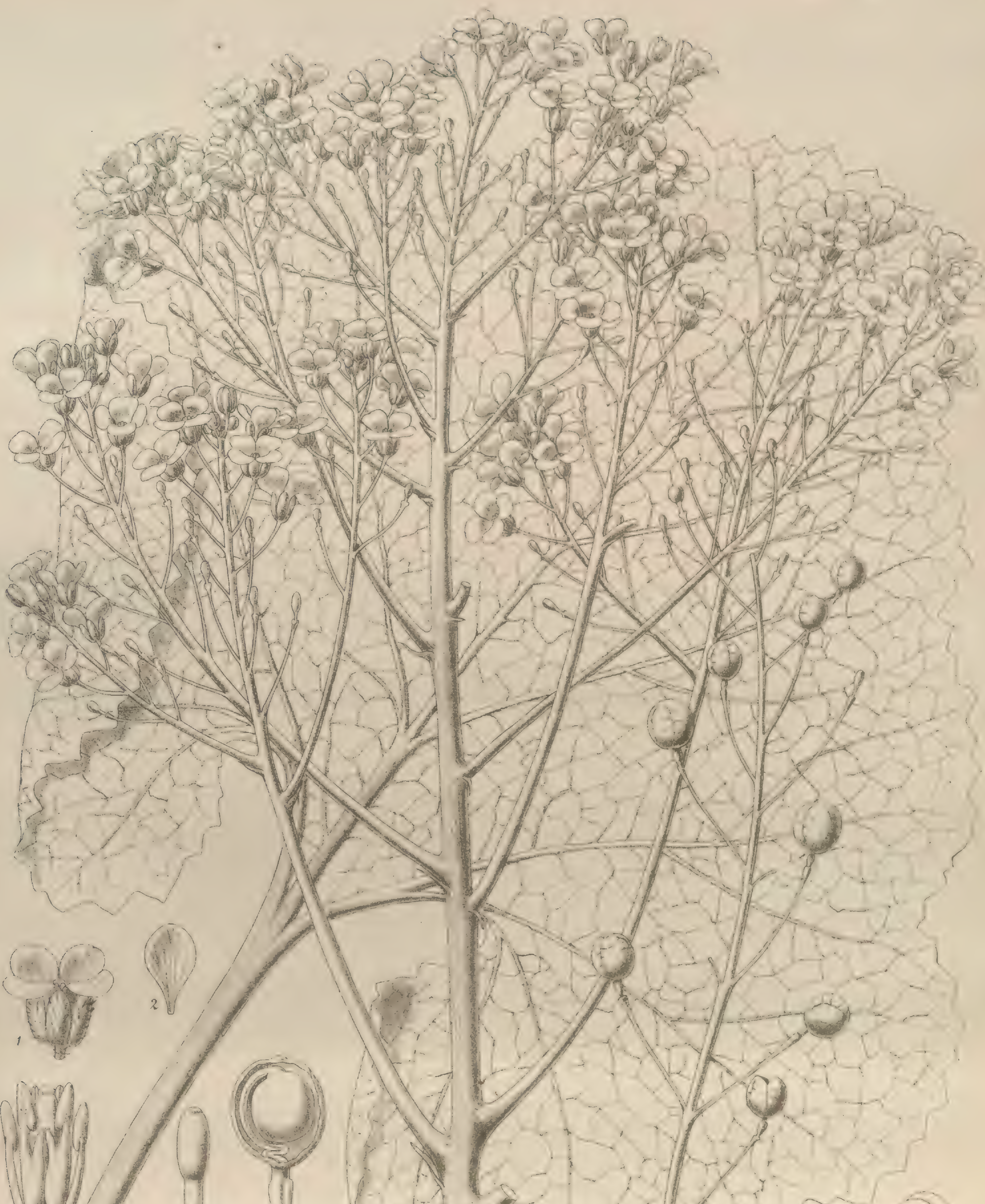


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

DELPHINIUM ZALIL, *Aitch. et Hemsl.*

Hanhart imp.

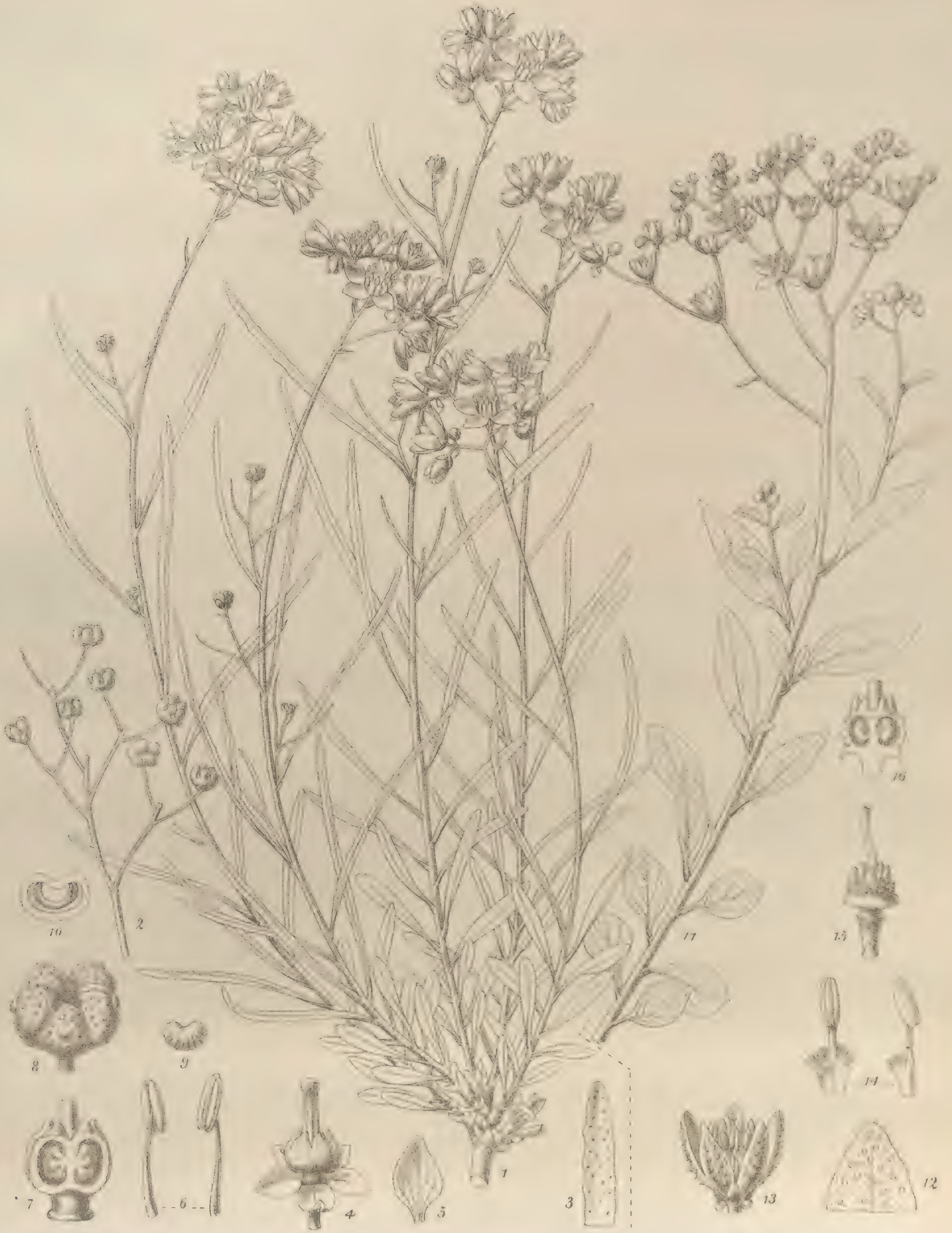


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

Hanhart imp.

CRAMBE CORDIFOLIA, *Stev.*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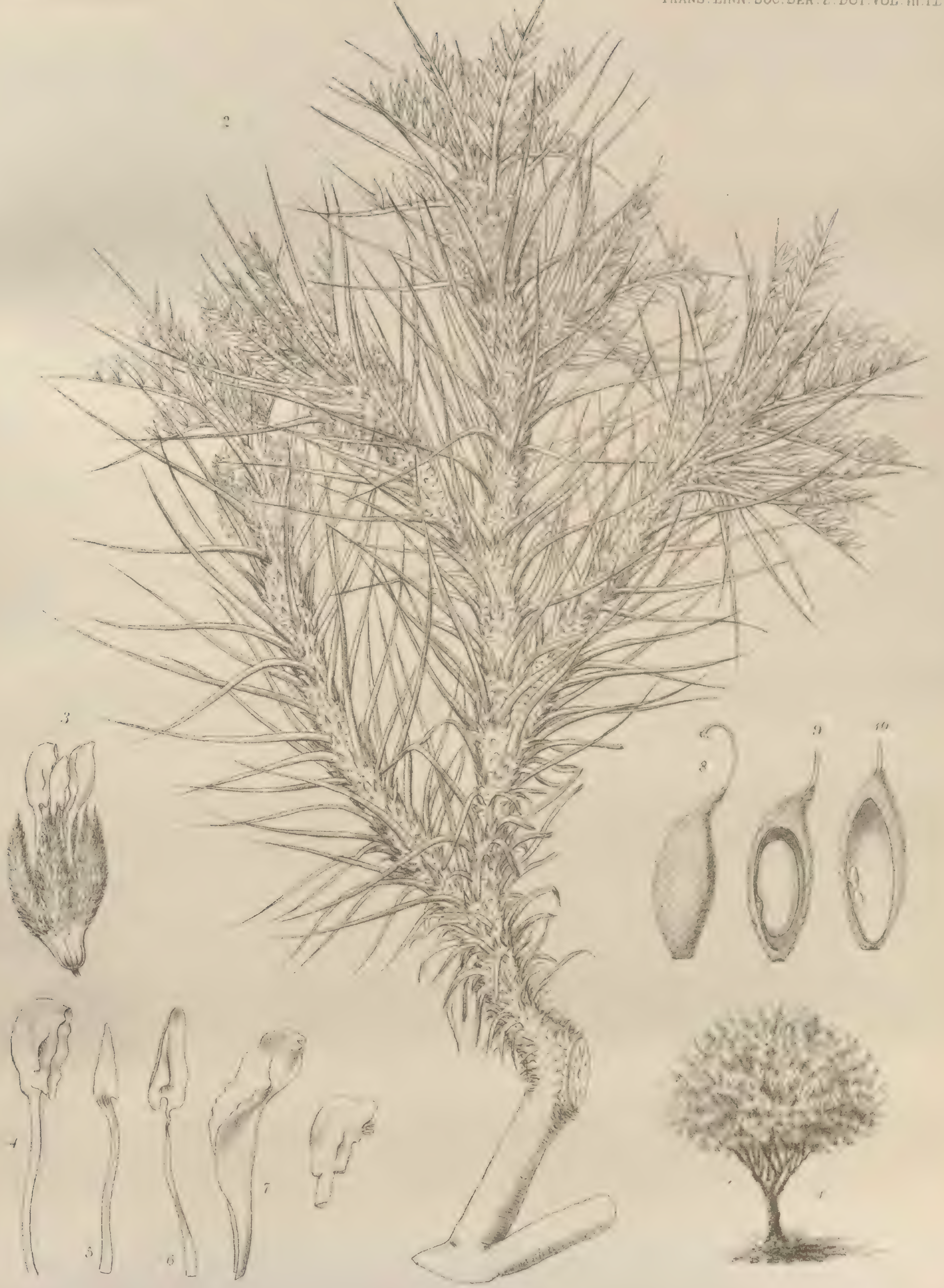
M. Smith del. J. Allen lith.

W. B. Hemsley dir.

Hanhart imp.

1–10 RUTA AFFINIS, *Aitch. et Hemsl.*
11–16 RUTA ROTUNDIFOLIA, *Aitch. et Hemsl.*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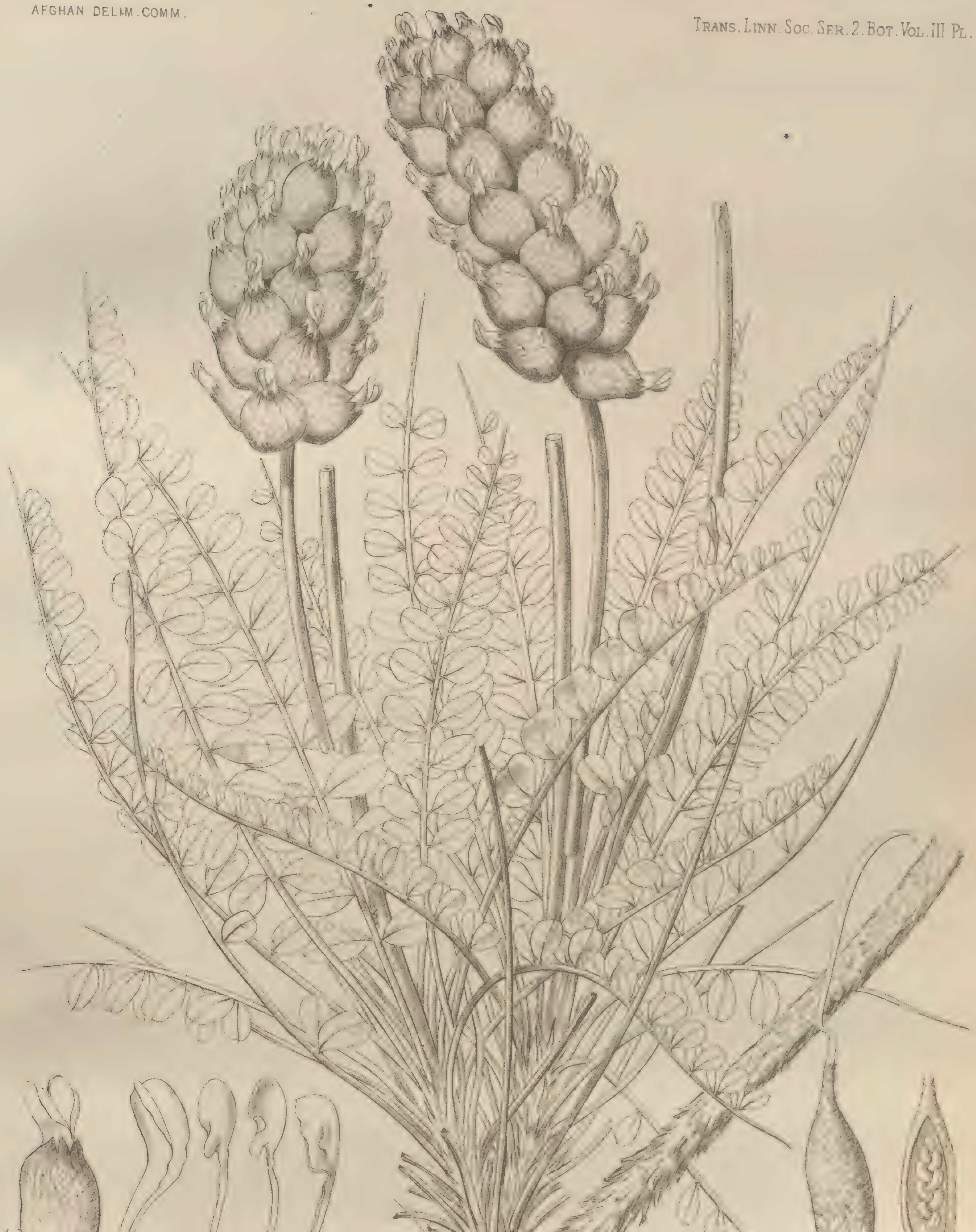
J. Allen del. et lith.

W. B. Hemsley dir.

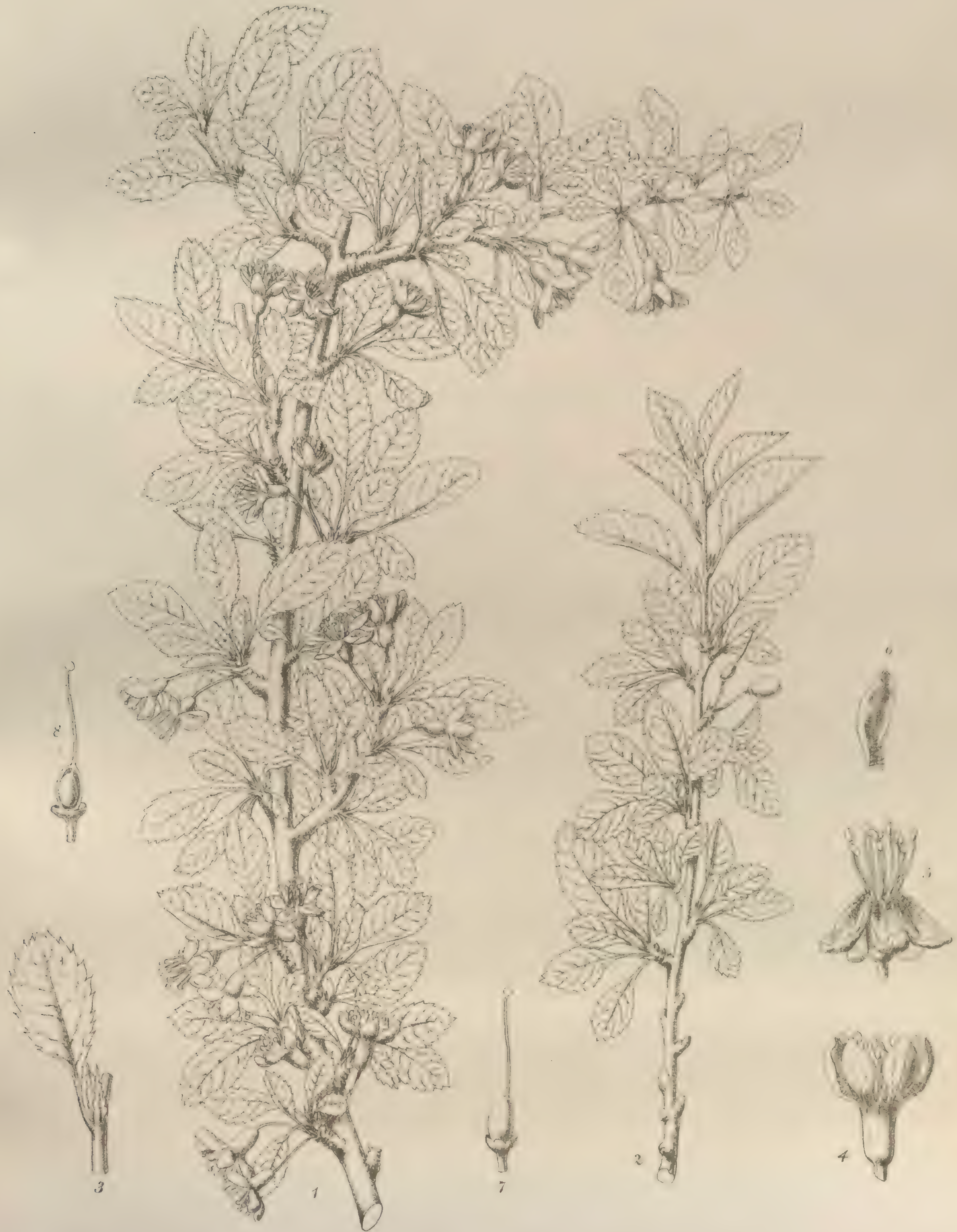
Hanhart imp.

ASTRAGALUS HERATENSIS, *Bunge*.



J. Allen del. et lith.
W. B. Hemsley dir.
Hanhart imp.

ASTRAGALUS LUMSDENIANUS, *Aitch et Baker*.

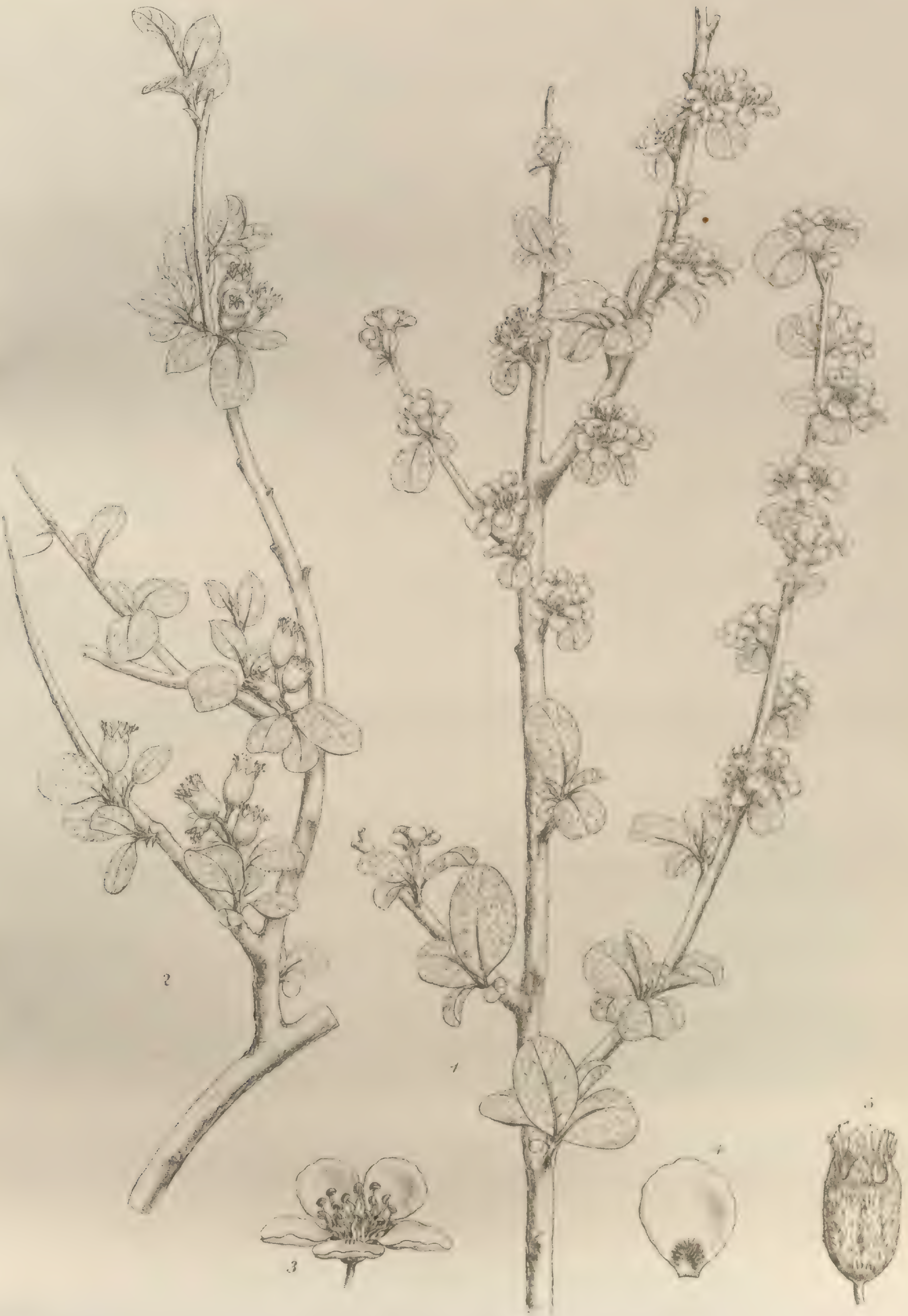


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

PRUNUS CALYCOSUS, *Aitch. et Hemsl.*

Hanhart imp.

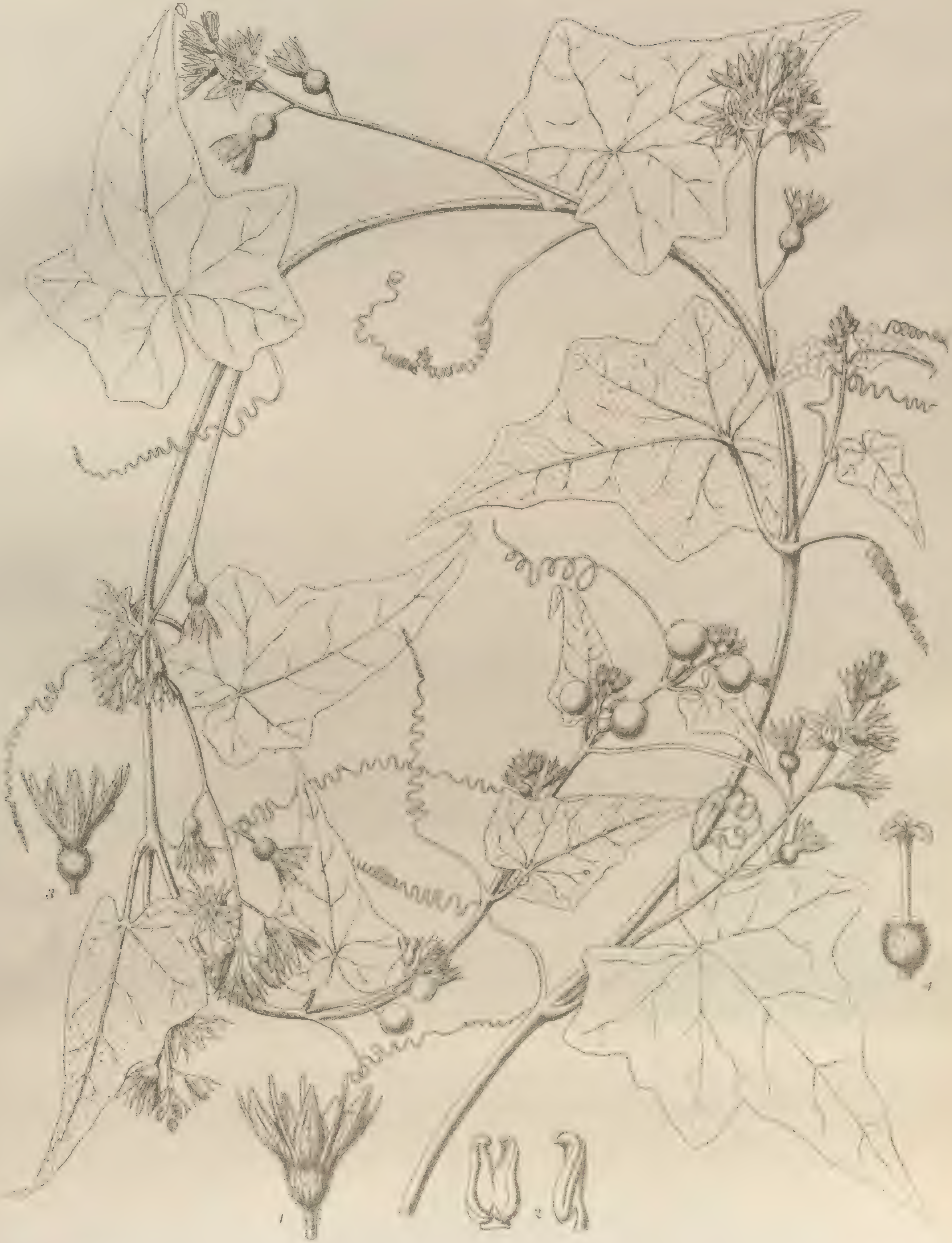


J Allen del. et lith.

W. B. Hemsley dir

Hanhart imp

COTONEASTER NUMMULARIA, *Fisch. et Meyer*.

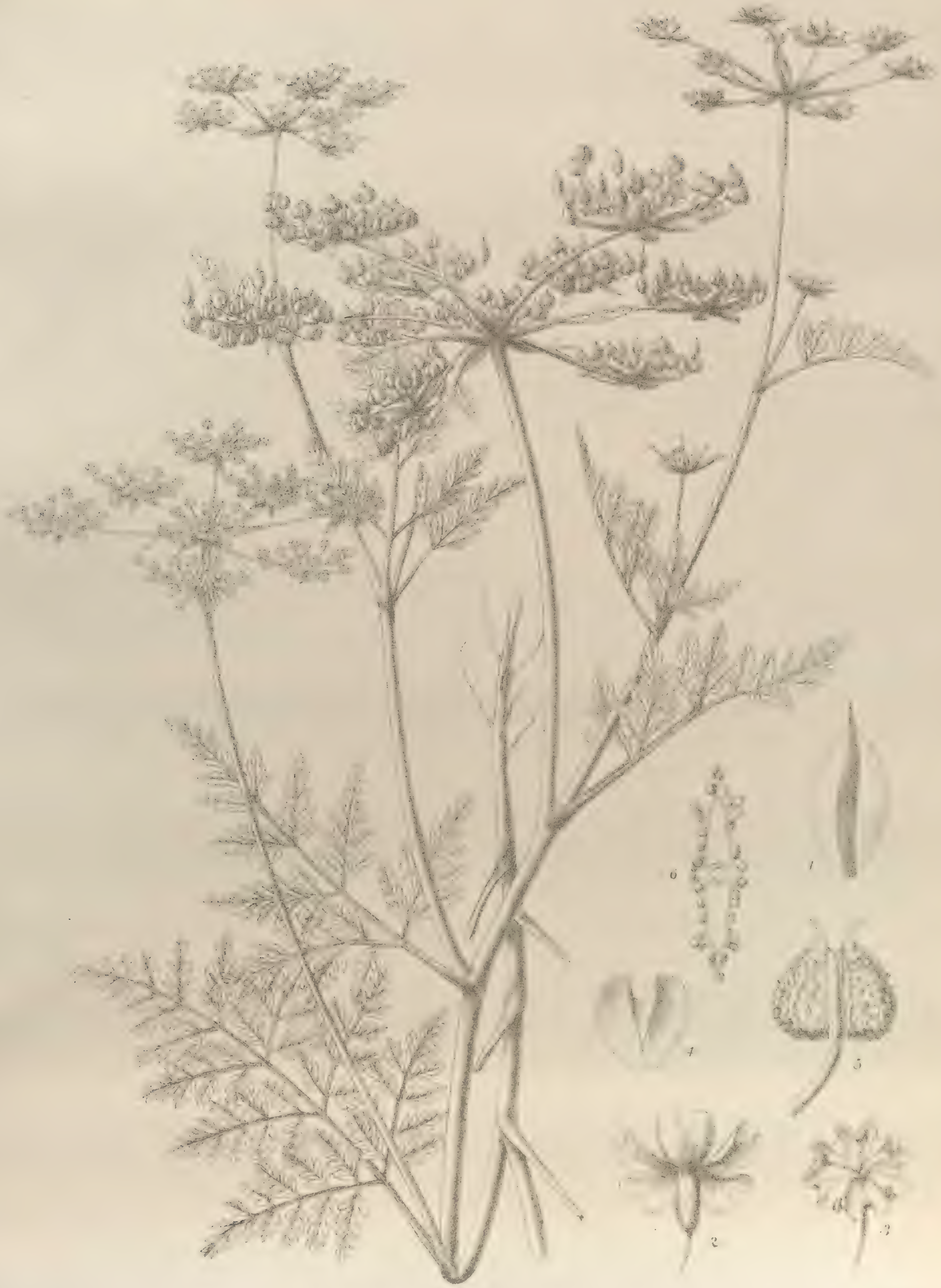


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

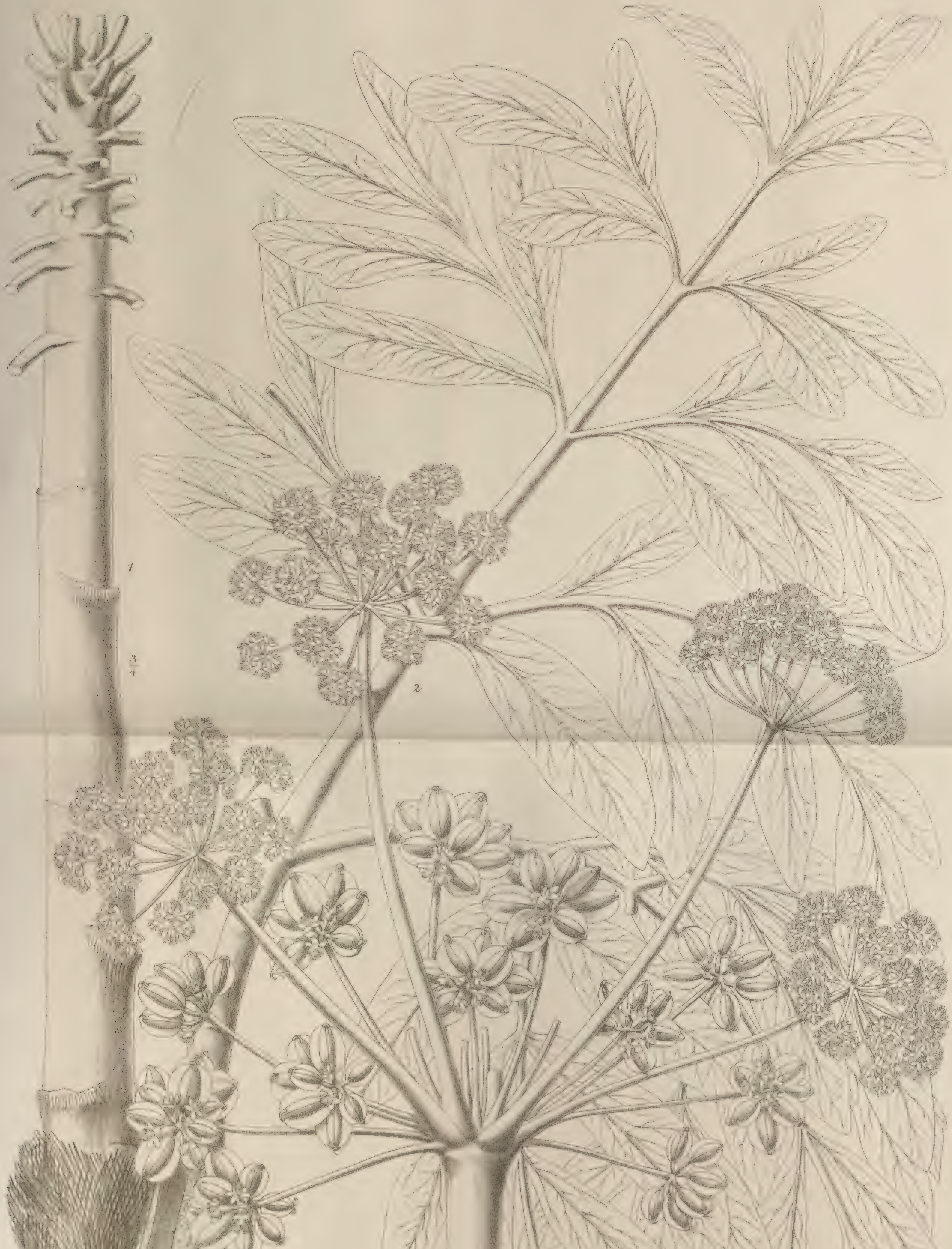
Hanhart imp.

BRYONIA MONOICA, *Aitch. et Hemsl.*



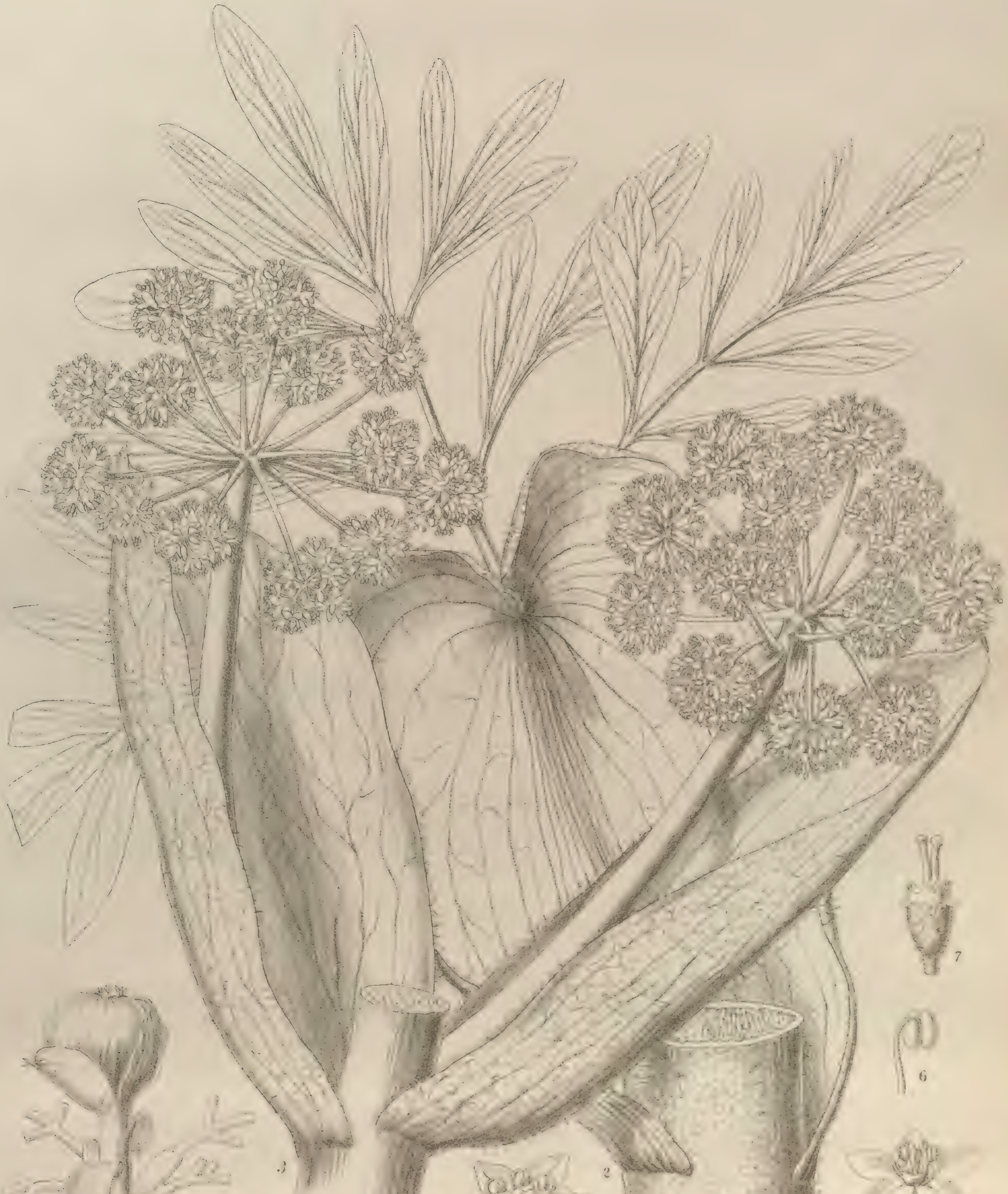
J. Allen del et lith W. B. Hemsley dir. Hanhart imp.

TRACHYDIUM LEHMANNII, *Benth. et Hook. f*



M Smith del J Allen lith
W. B Hemsley dir
Hanhart imp.

FERULA FŒTIDA, *Regel.*



M. Smith del. J. Allen lith.

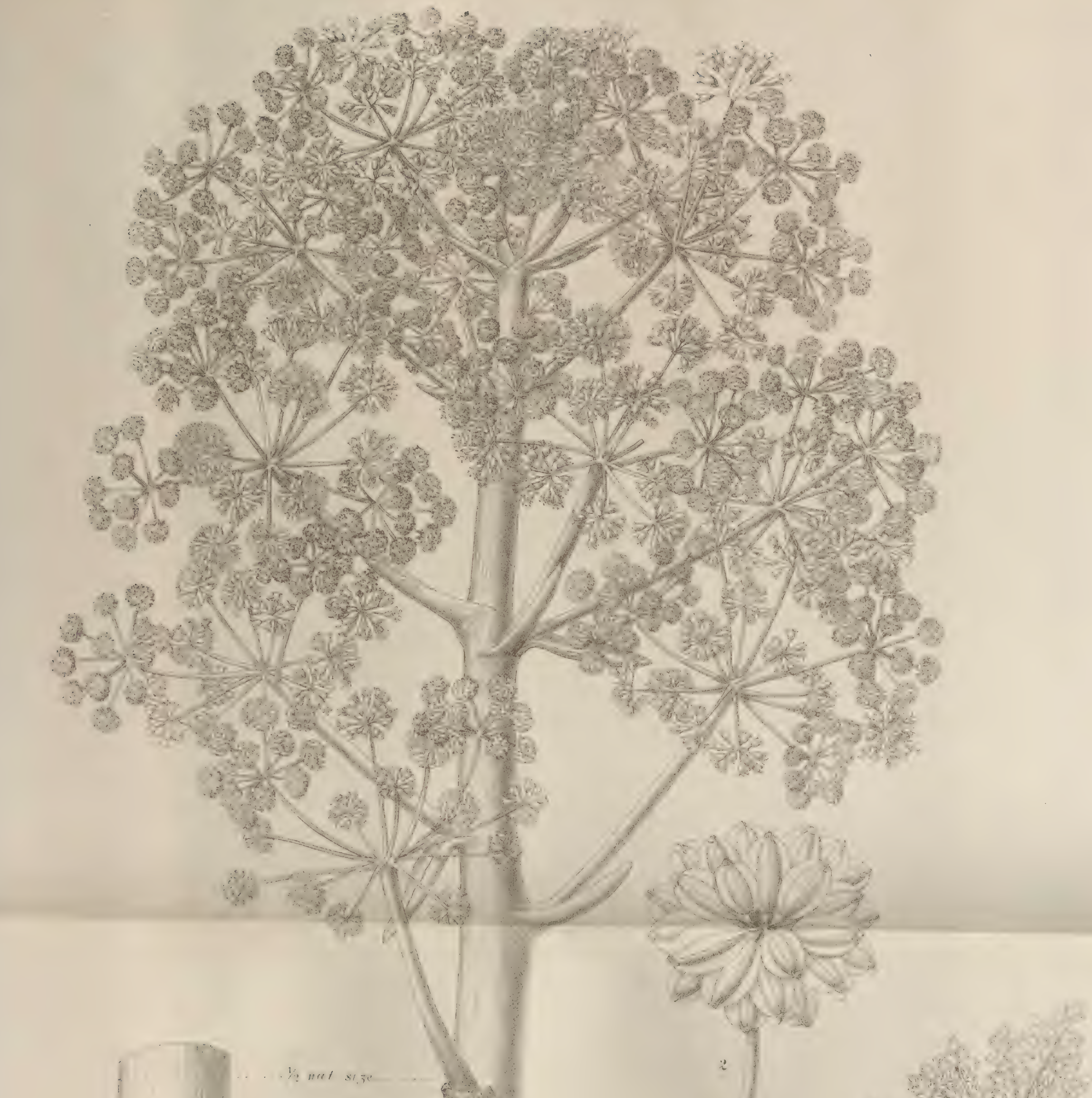
W. B. Hemsley dir.

Hanhart imp.

FERULA FŒTIDA, *Regel.*

AFSHAN DELIM COMM.

LINN. SOC. SER. 2. BOT. VOL. III. PL. 15 & 16.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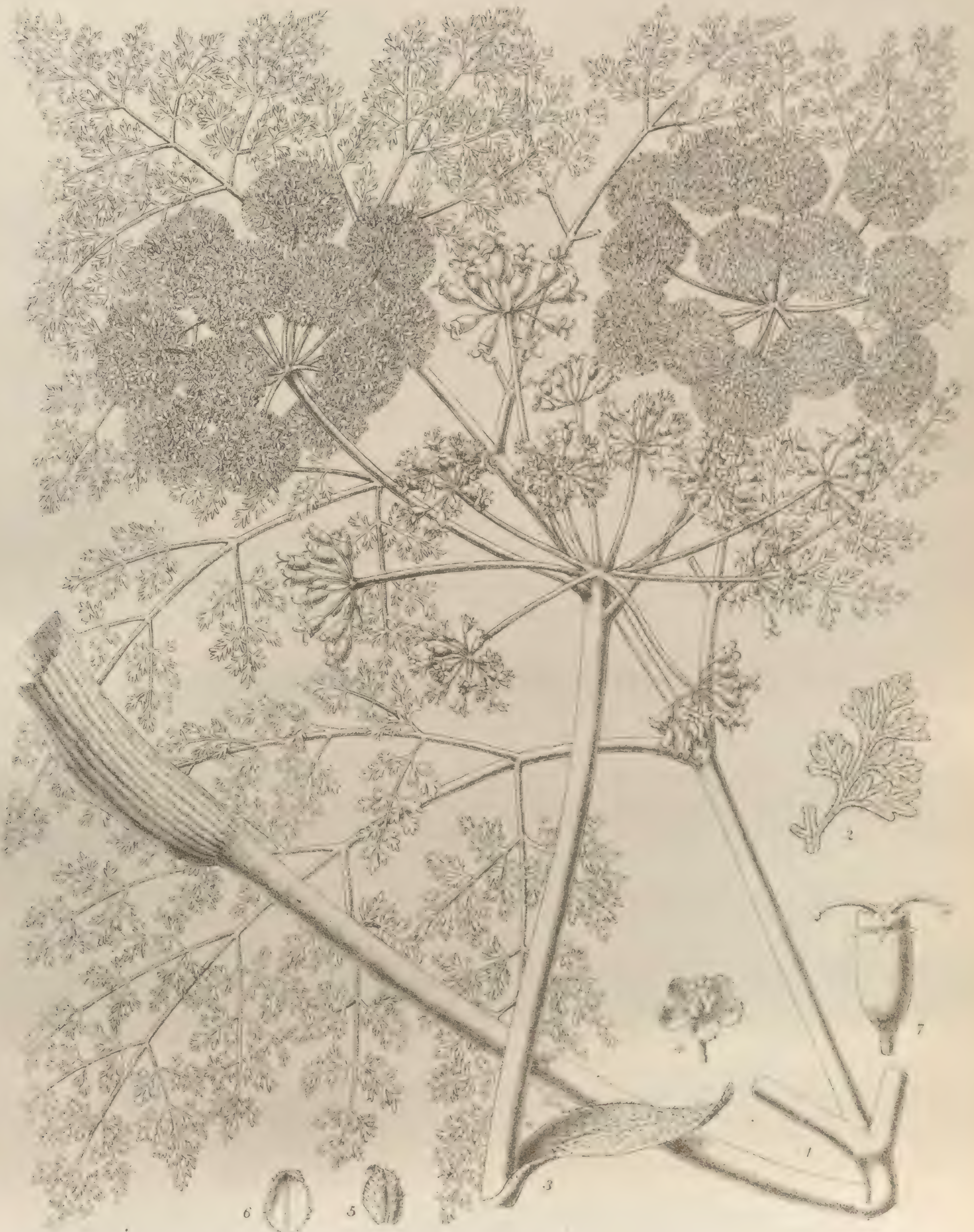
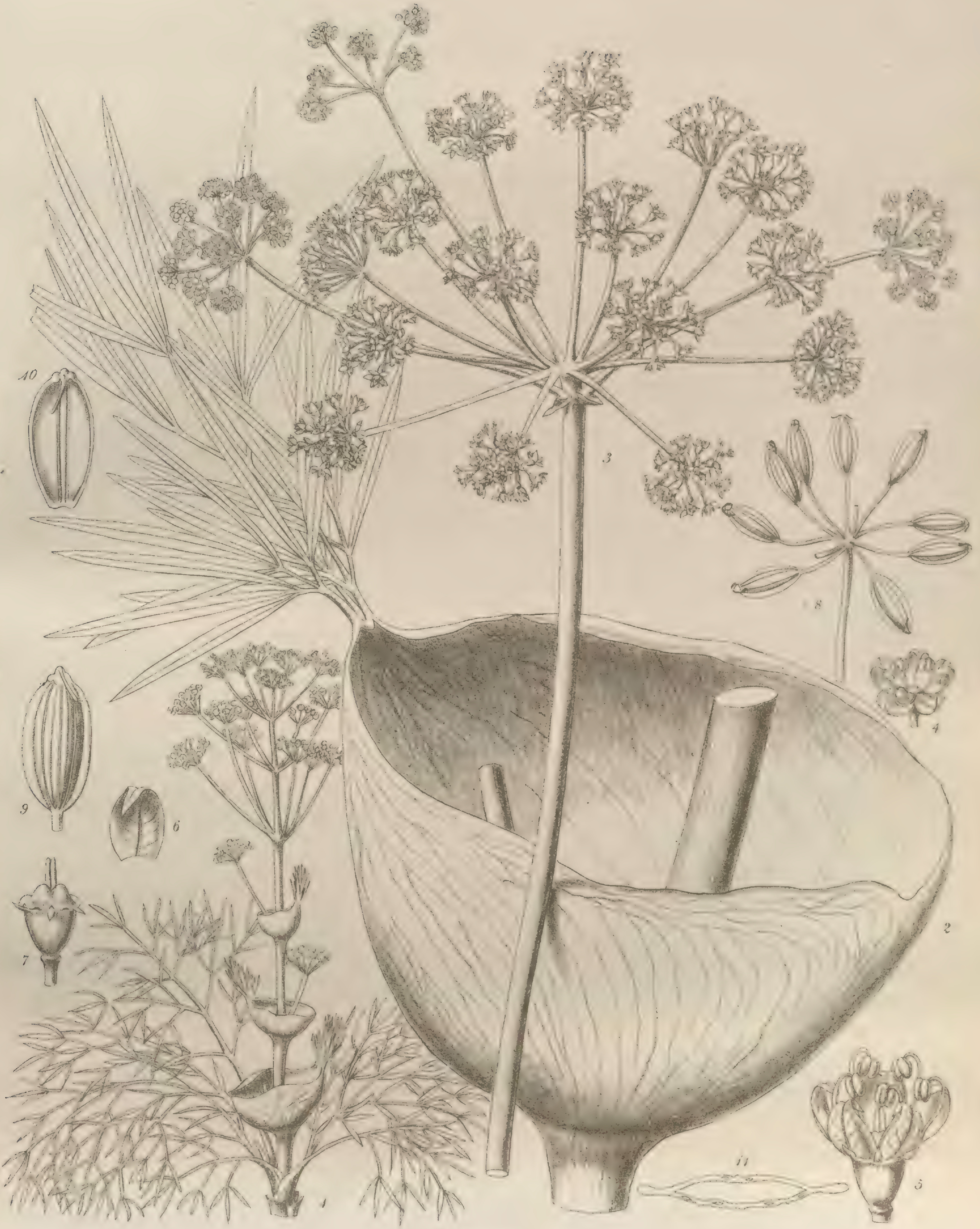
M. Smith del. J. Allen lith.
W. B. Hemsley dir.
Hanhart imp.

FERULA GALBANIFLUA, *Boiss*



M. Smith del. J. Allen lith. W. B. Hemsley dir. Hanhart imp

FERULA GALBANIFLUA, *Boiss.*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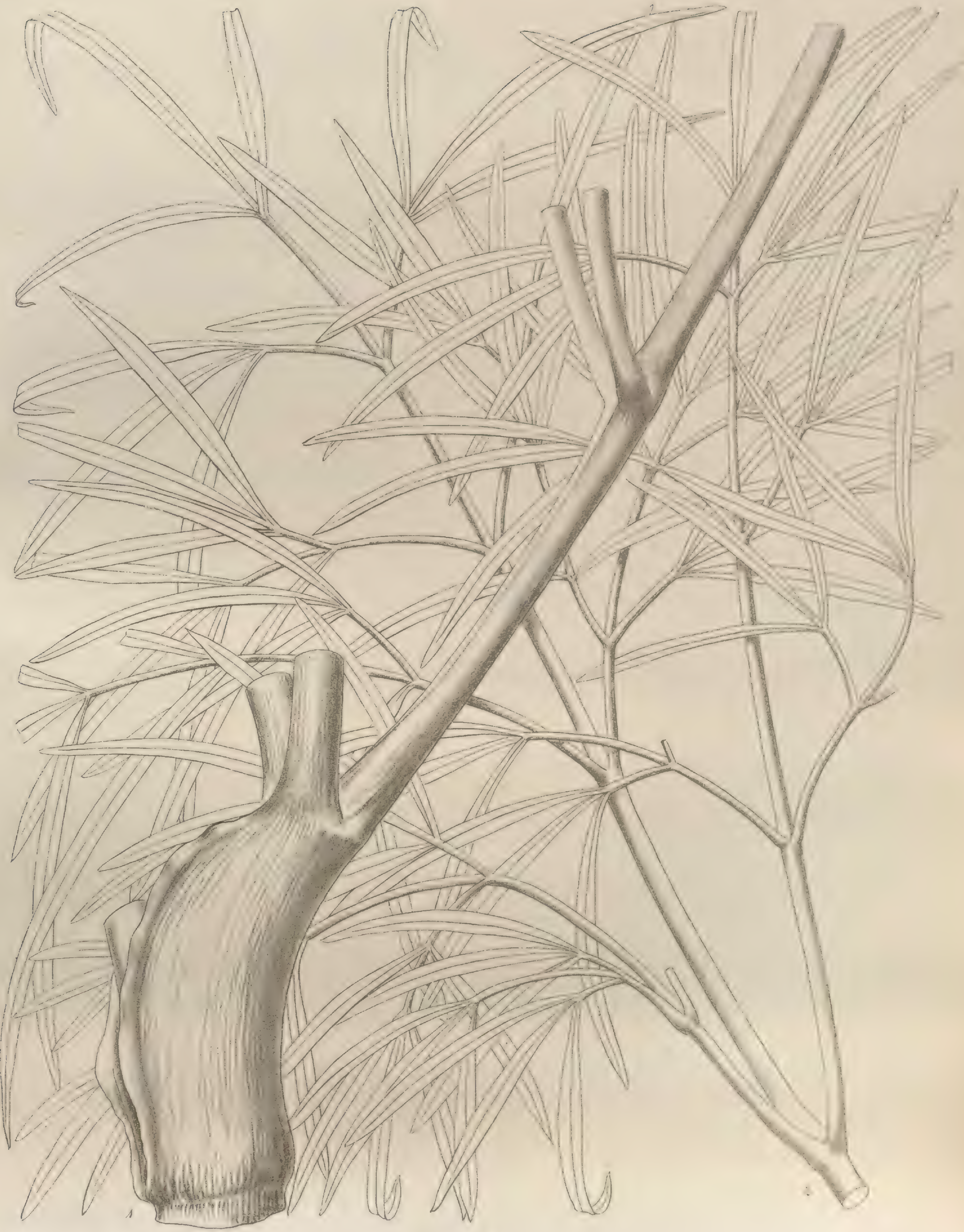
M.Smith del. J.Allen lith.

W.B.Hemsley dir.

Hanhart imp.

FERULA OOPODA, *Boiss.*

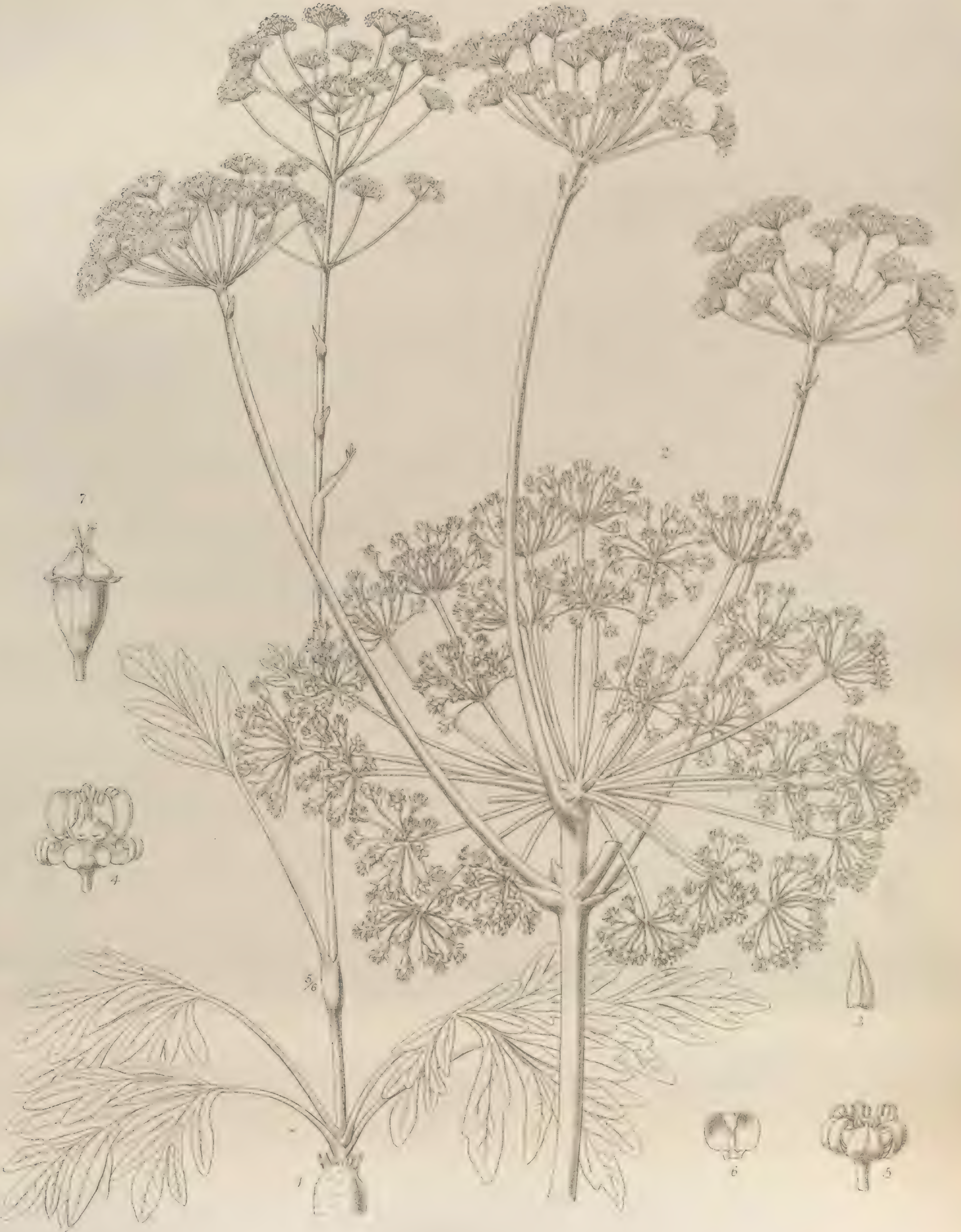


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

FERULA OOPODA, *Boiss.*

Hanhart imp.

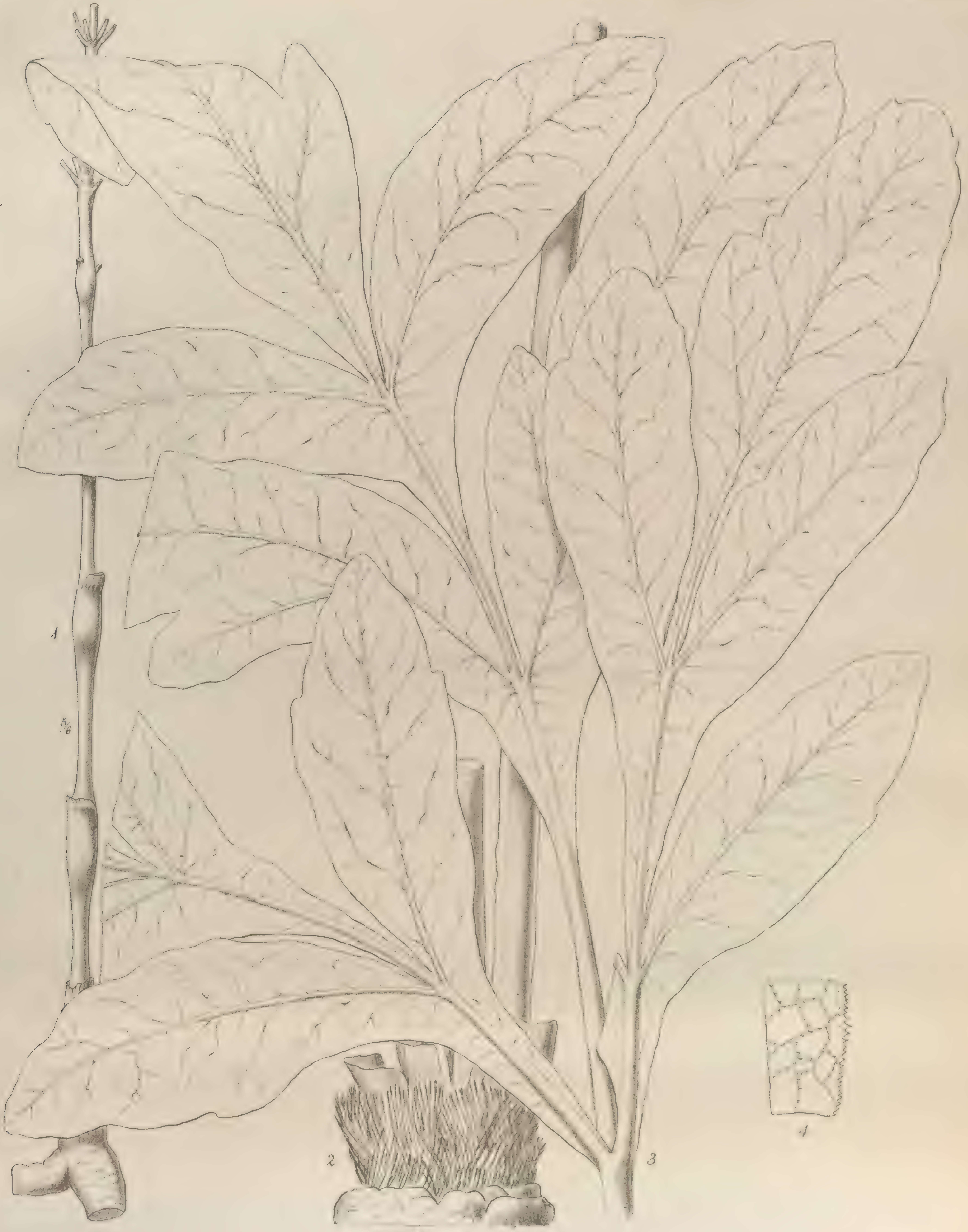


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

Hanhart imp.

FERULA SUAVEOLENS, *Aitch. et Hemsl.*

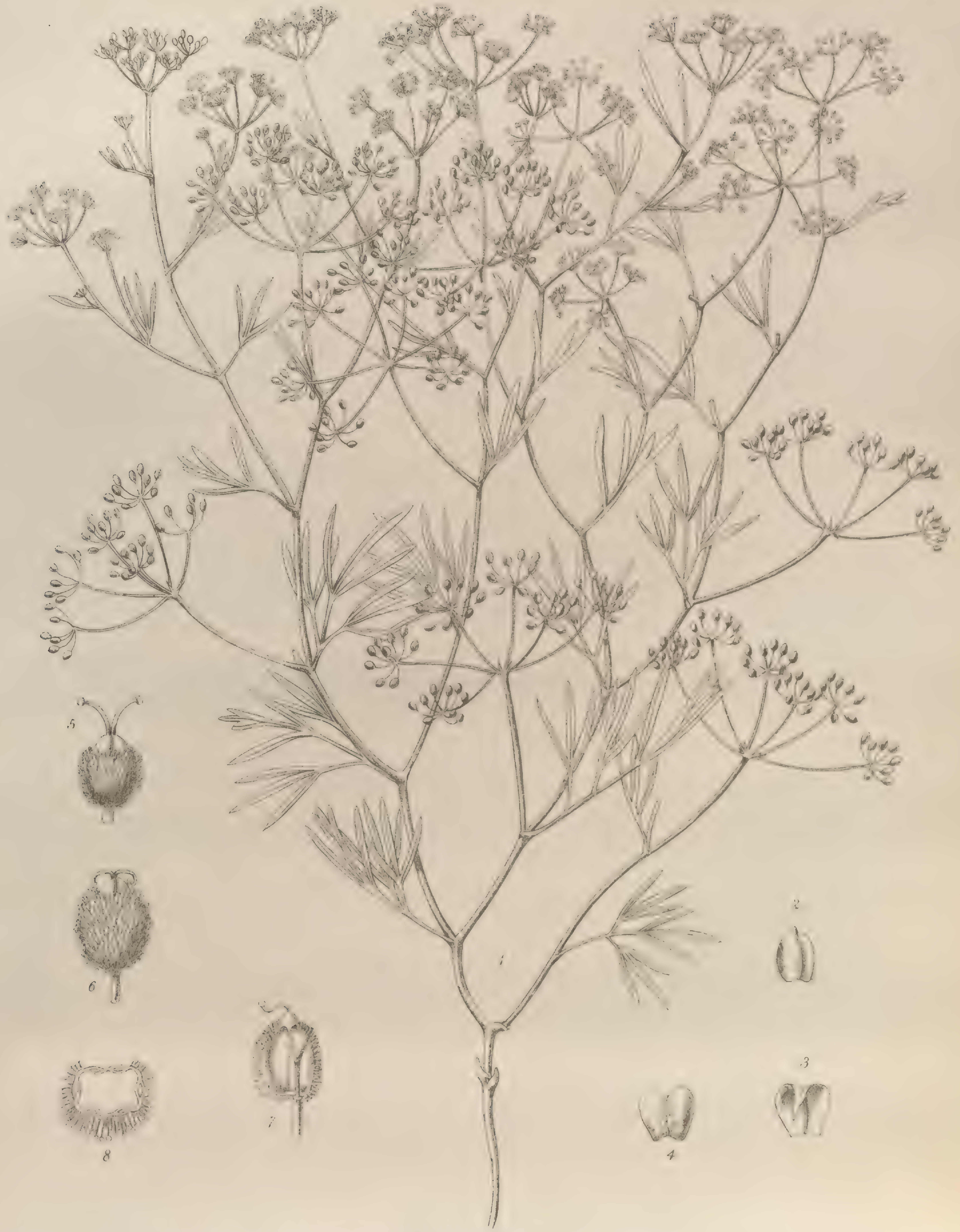


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

FERULA SUAVEOLENS, *Aitch. et Hemsl.*

Hanhart imp.



M Smith del. J. Allen lith.

W. B. Hemsley dir.

CARUM LEPTOCLADUM, *Aitch. et Hemsl.*

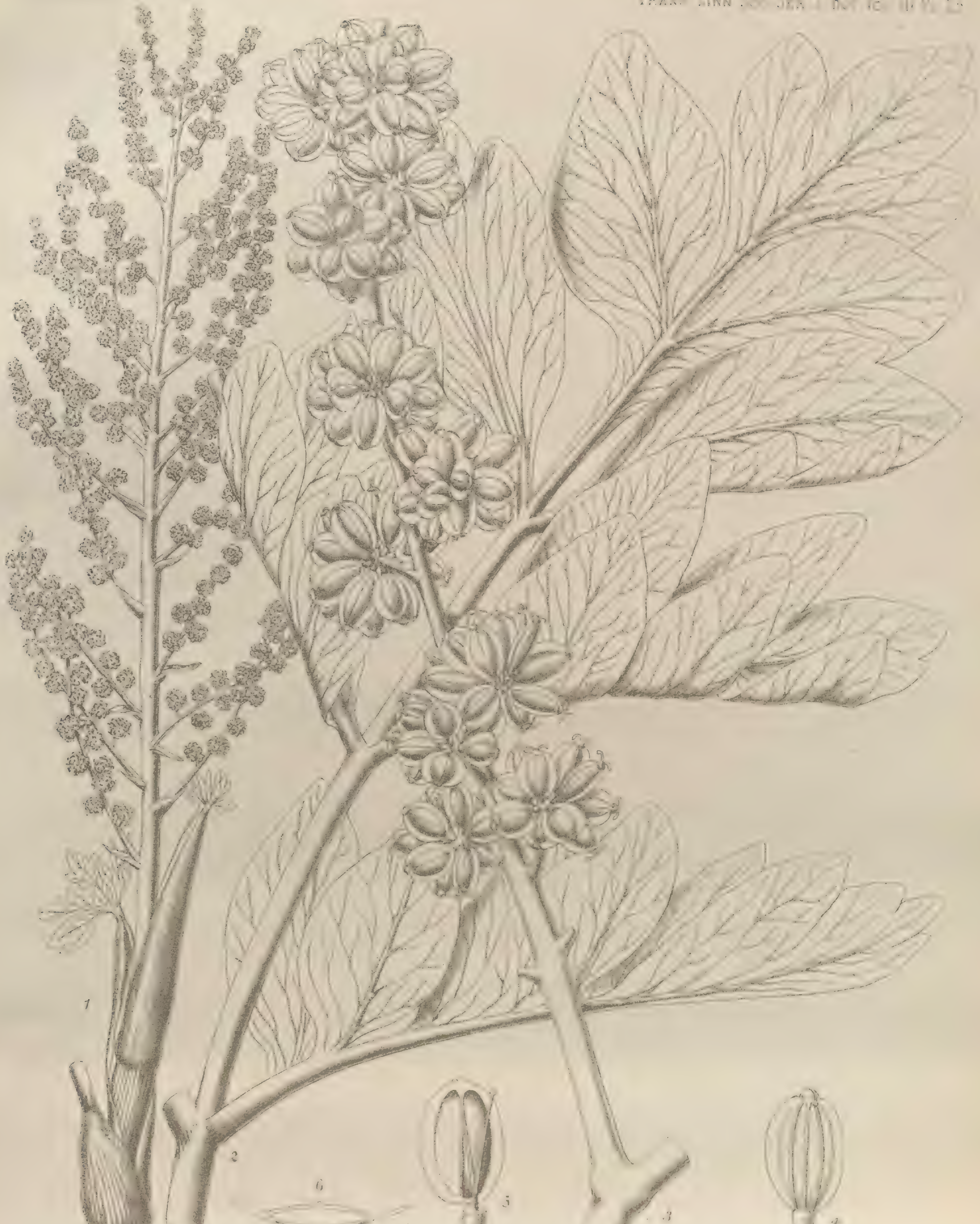
Hanhart imp.

M. Smith del. J. Allen lith.

W. B. Hemsley dir.

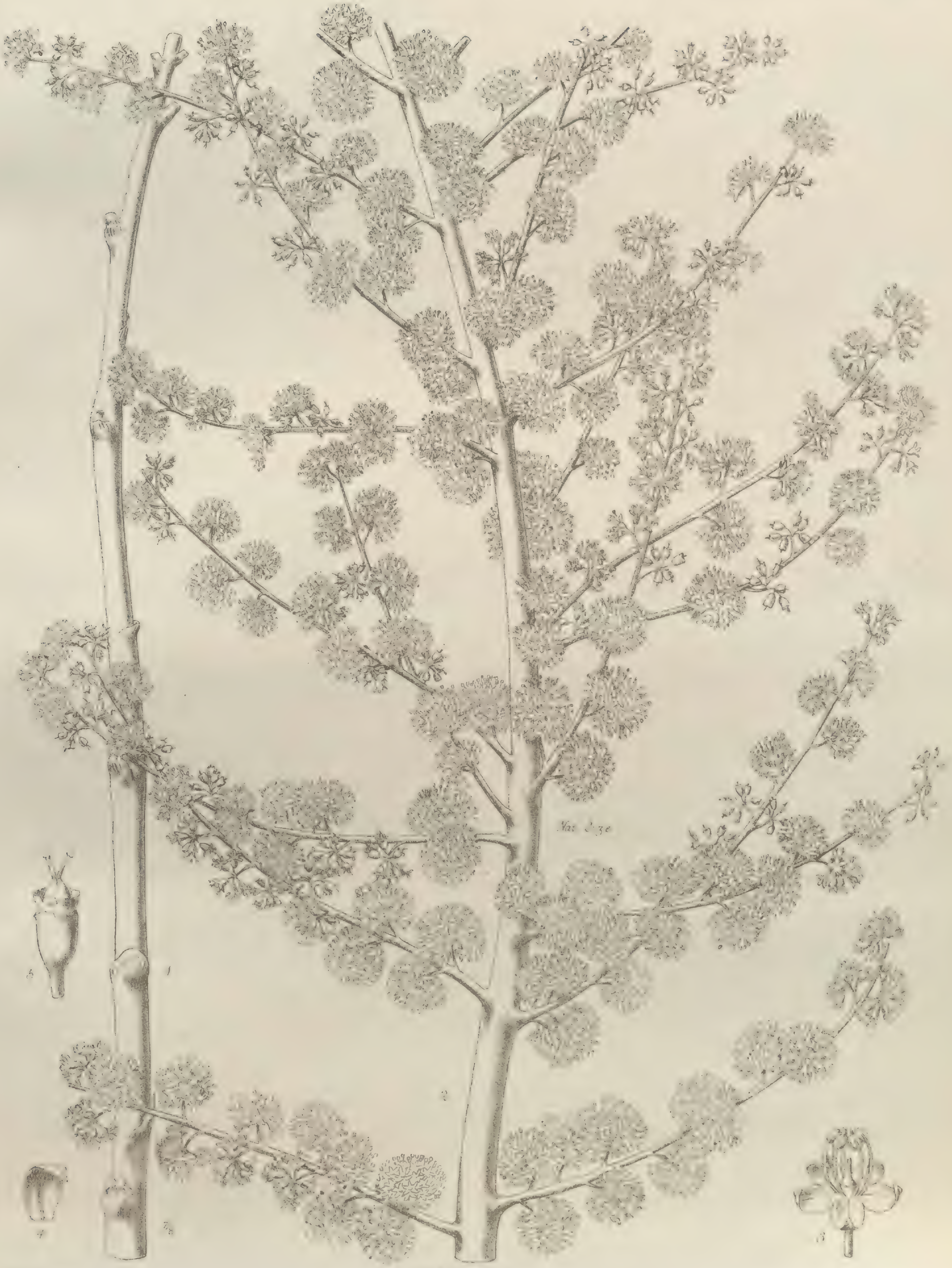
DOREMA AMMONIACUM, *D. Don.*

Hanhart imp.



M. Smith del. J. Allen lith.
W. B. Hemsley dir.
Hanhart imp.

DOREMA AMMONIACUM, *D. Don.*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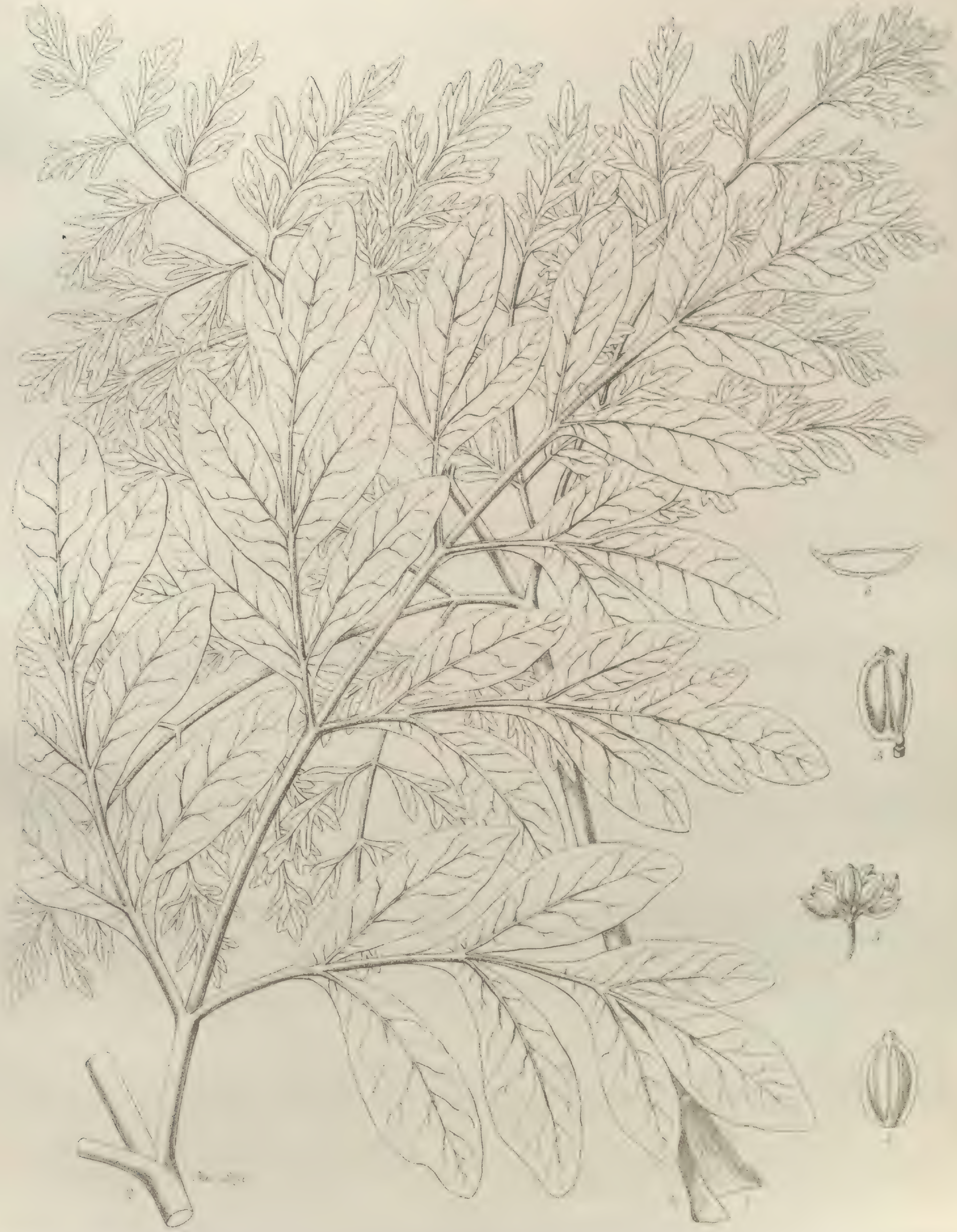
M. Smith del. J. Allen lith.

W. B. Hemsley dir.

DOREMA GLABRUM, *Fisch. et Mey.*

Hanhart imp.



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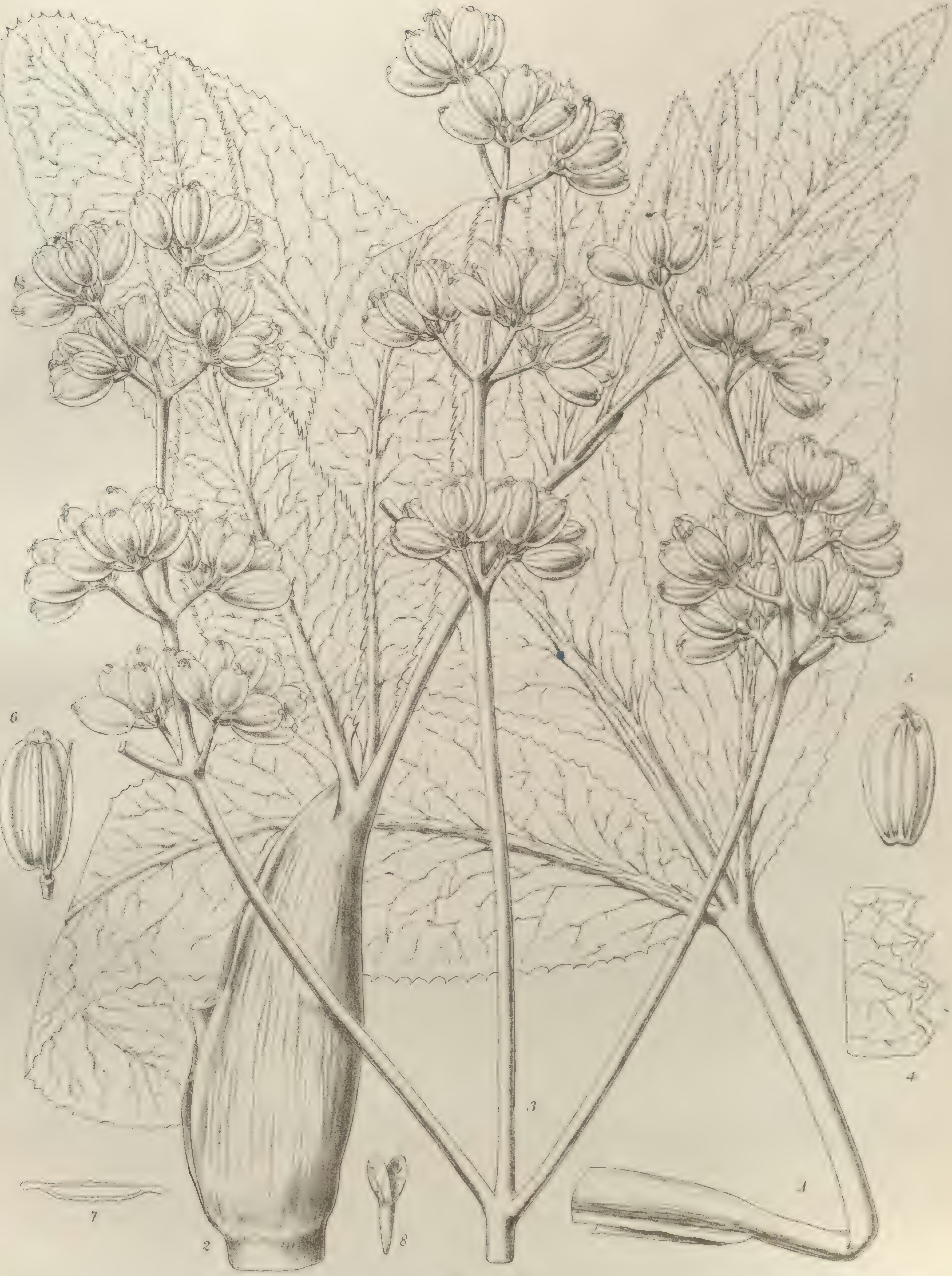
DOREMA GLABRUM, *Fisch et Mey.*

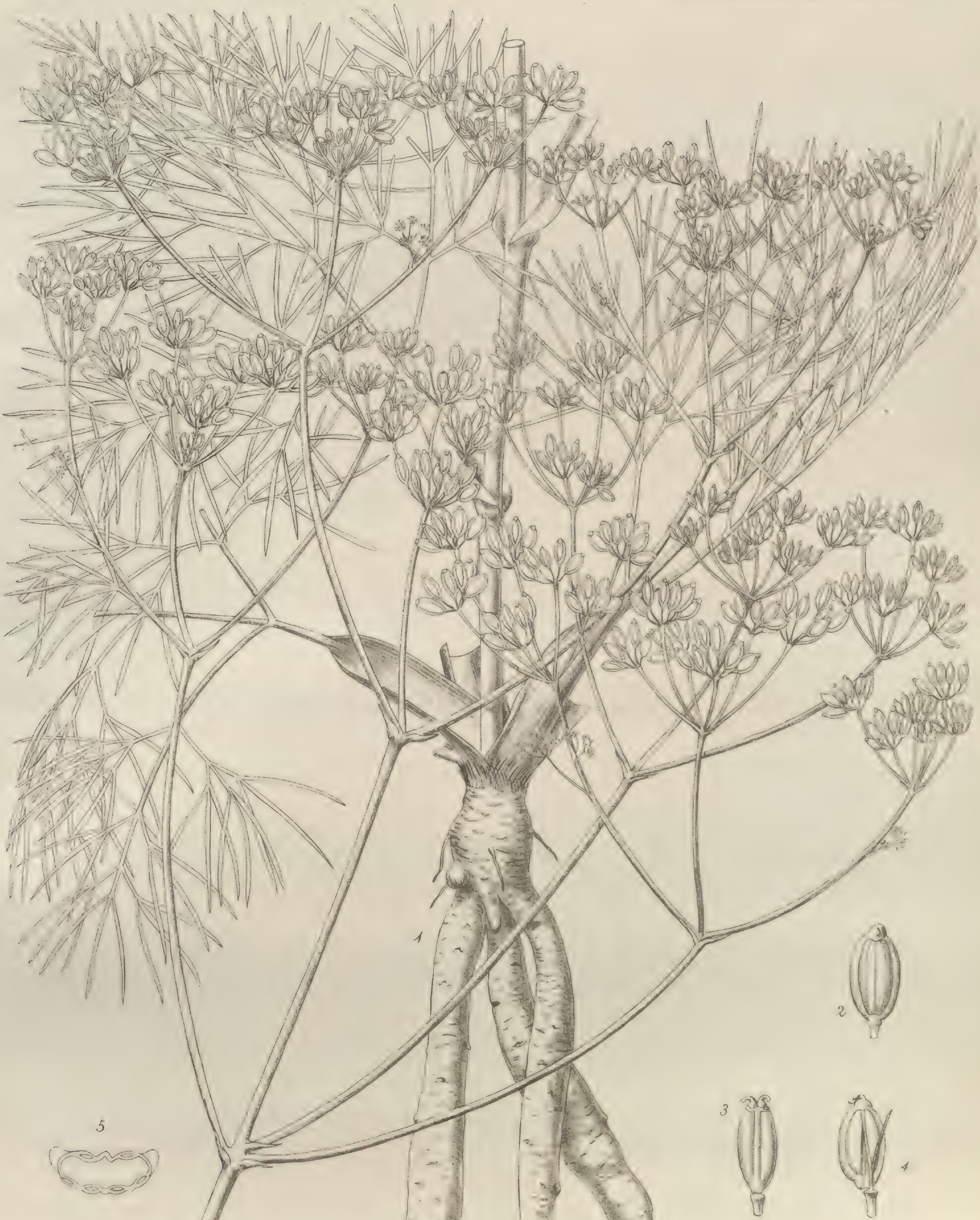


M. Smith del. J. Allen lith.

W. B. Hemsley dir

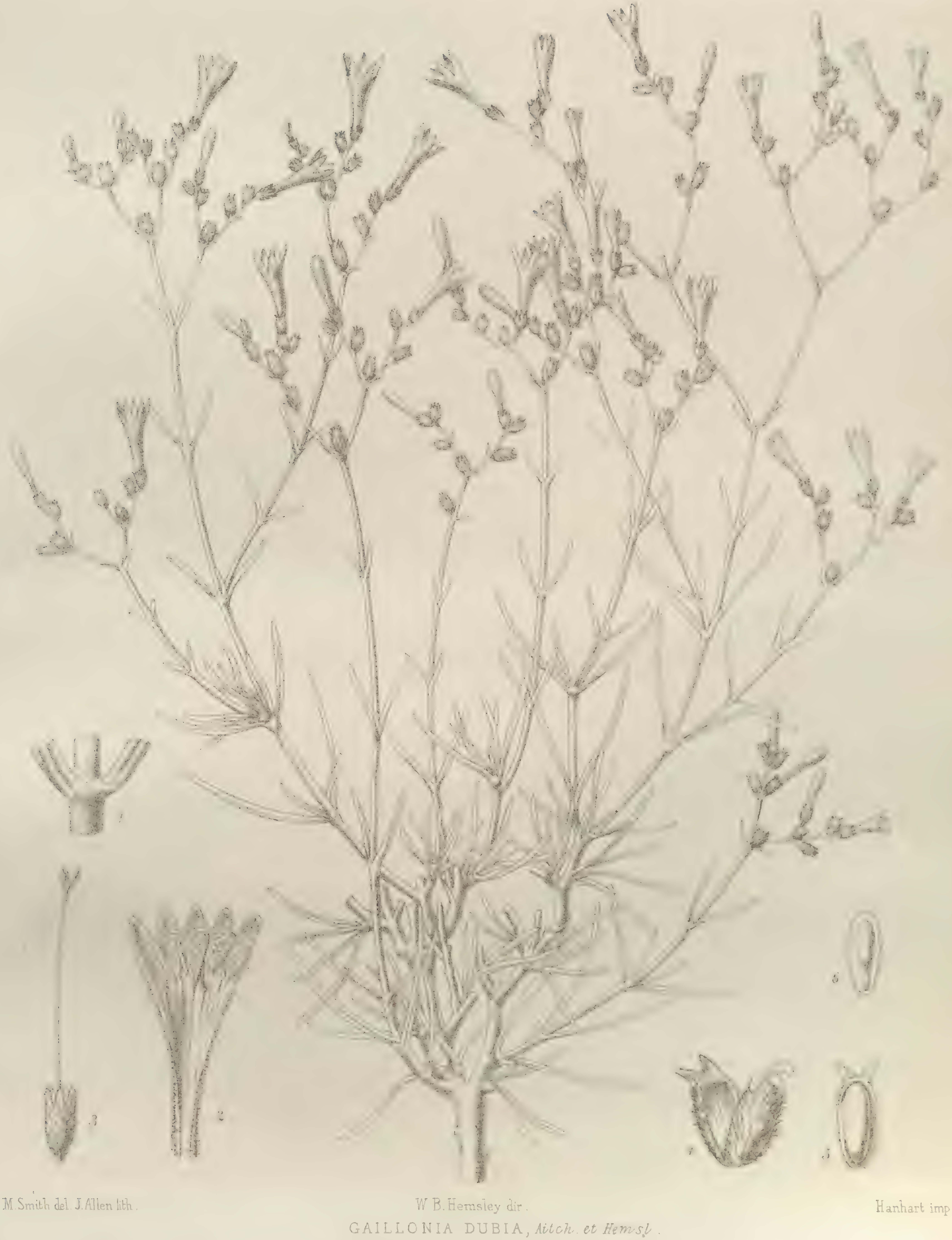
Hanhart imp

DOREMA SERRATUM, *Aitch. et Hemsl.*



W.B. Hemsley dir.
M. Smith del. J. Allen lith.
Hanhart imp

JOHRENIA PLATYPODA, *Aitch. et Hemsl.*



M. Smith del. J. Allen lith.

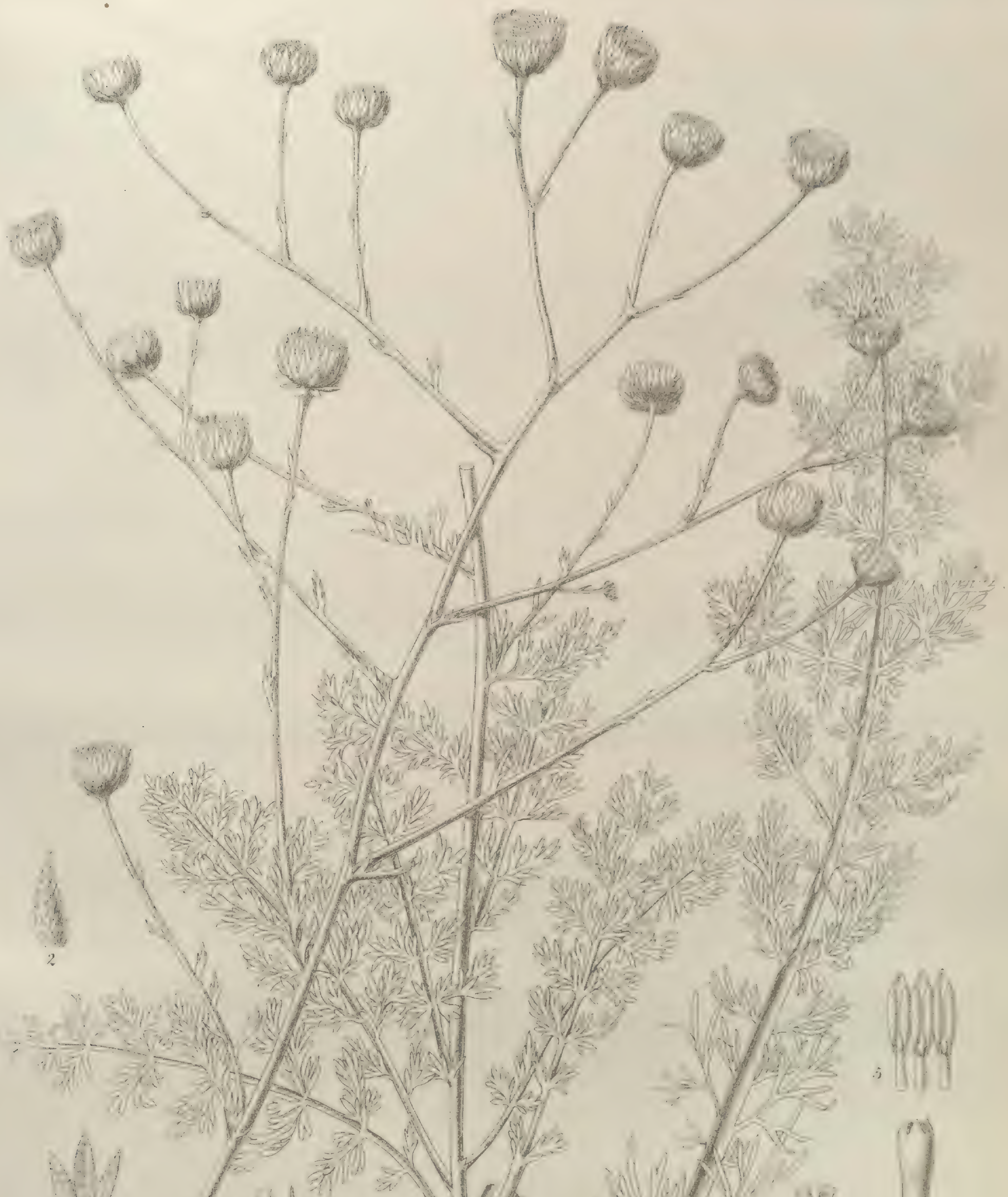
W. B. Hemsley dir.

Hanhart imp.

GAILLONIA DUBIA, *Aitch. et Hemsl.*

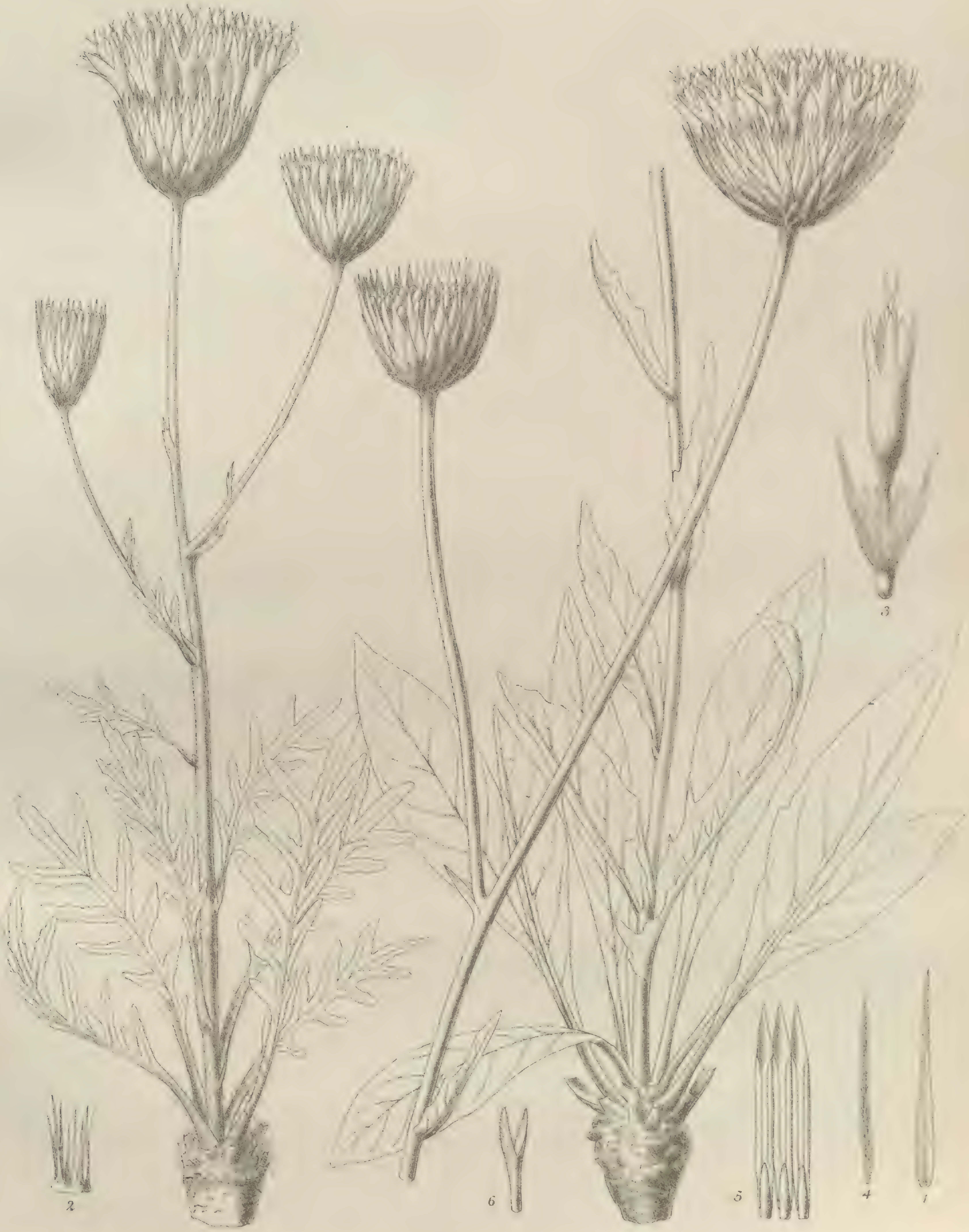
M. Smith del. J. Allen lith.   W. B. Hemsley dir.   Hanhart imp.

CODONOCEPHALUM PEACOCKIANUM, *Aitch. et Hemsl.*



M. Smith del. J. Allen lith.
W. B. Hemsley dir.
Hanhart imp.

ANTHEMIS CAULESCENS, *Aitch. et Hemsl.*



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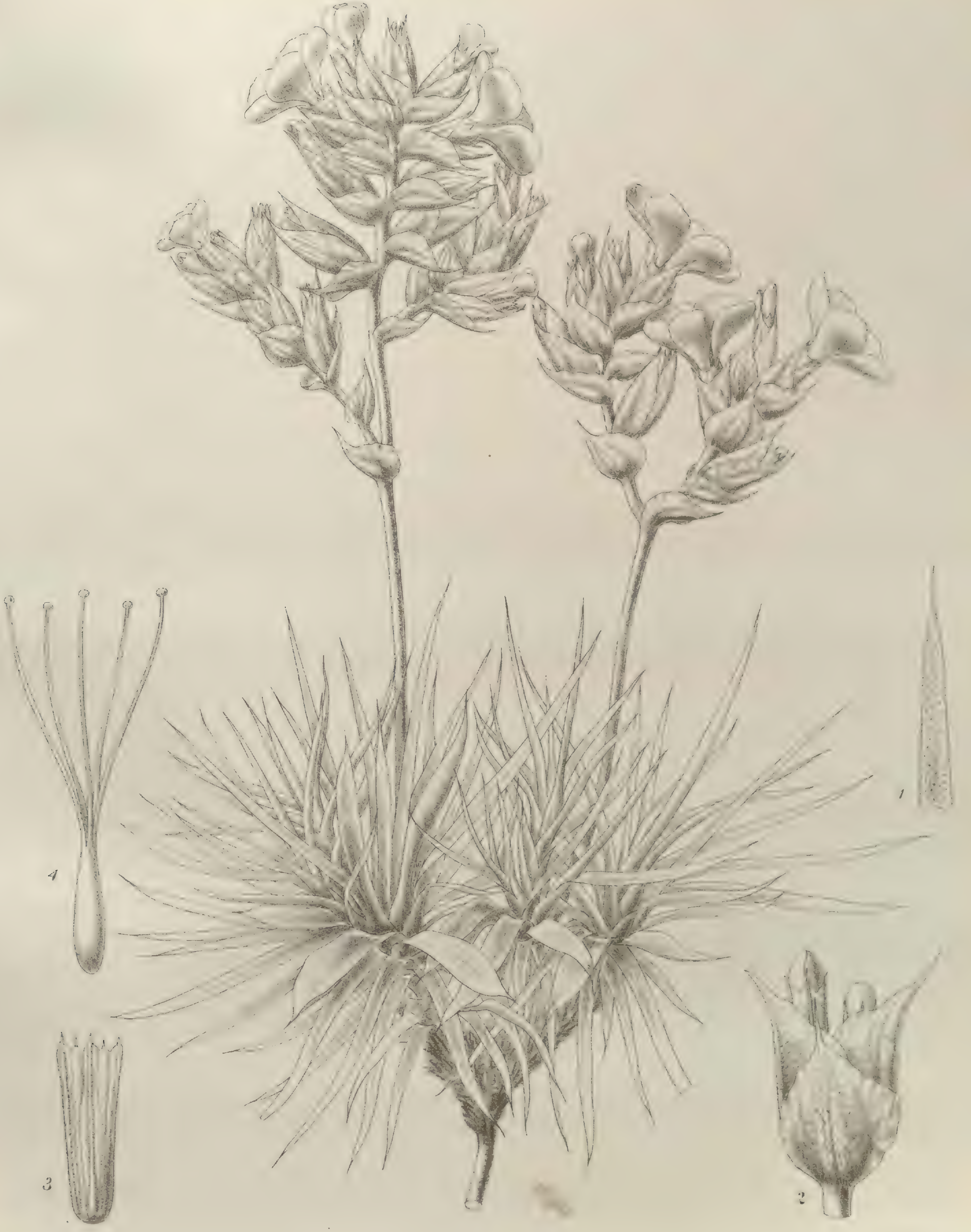
W. B. Hemsley dir.

Hanhart imp.

JURINEA VARIABILIS, *Aitch. et Hemsl.*



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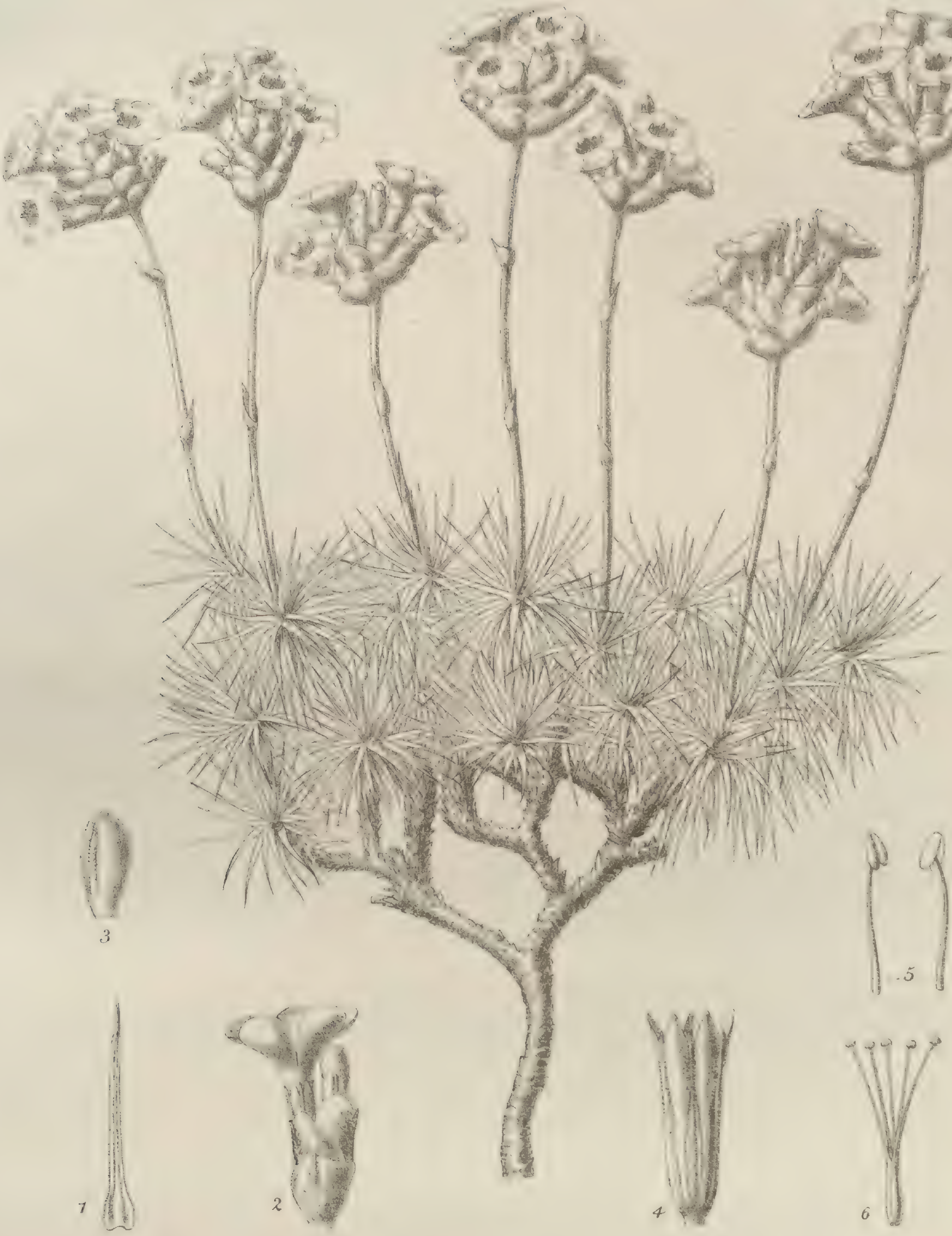
W. B. Hemsley dir.

Hanhart imp.

ACANTHOLIMON SPECIOSISSIMUM, *Aitch. et Hemsl.*

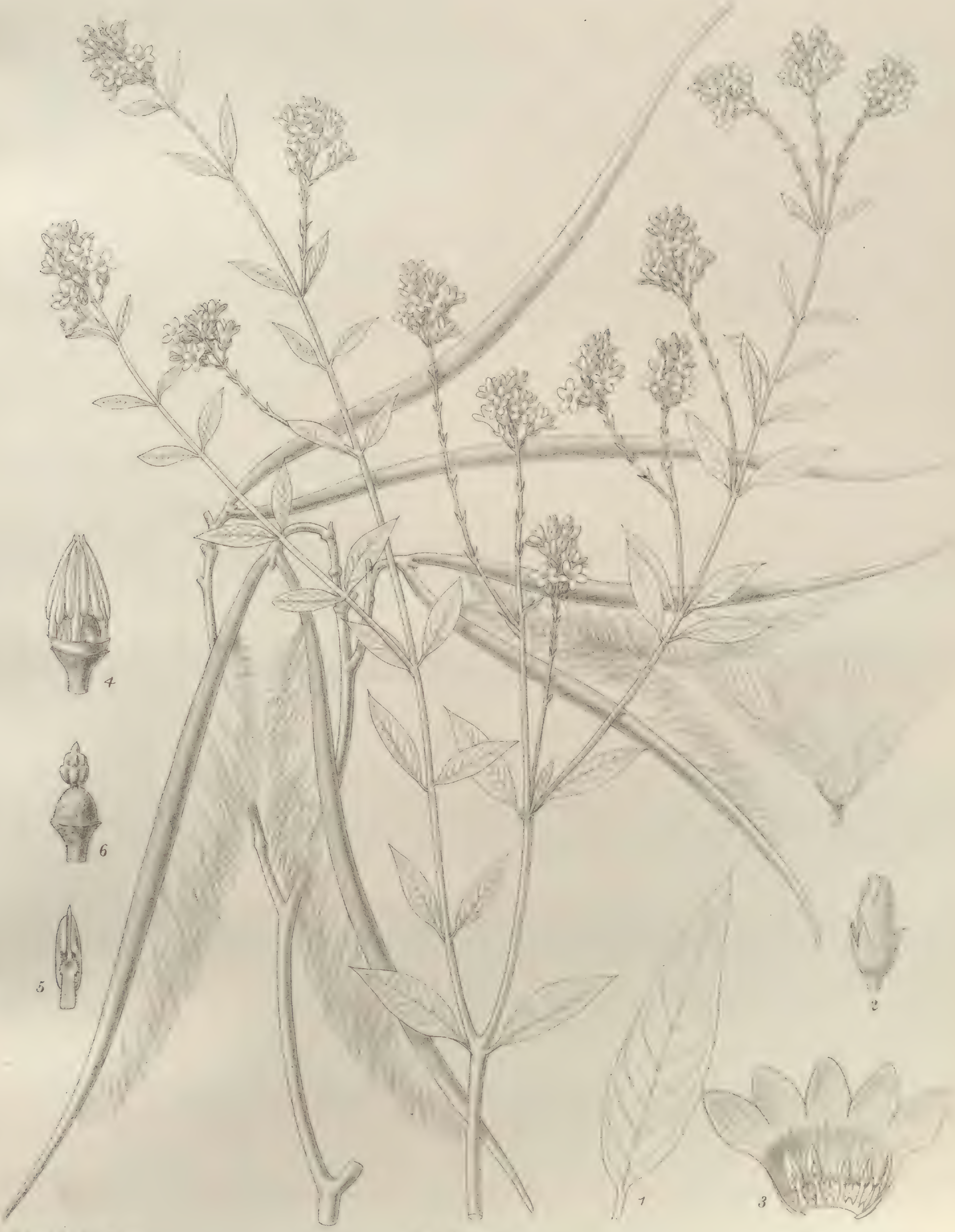


M. Smith del J. Allen lith.
W. B. Hemsley dir.
Hanhart imp.

ACANTHOLIMON ECÆ, *Aitch. et Hemsl.*

AFGHAN. DELIM COMM.

TRANS. LINN. SOC. SER. 2. BOT. VOL. III. PL. 37.



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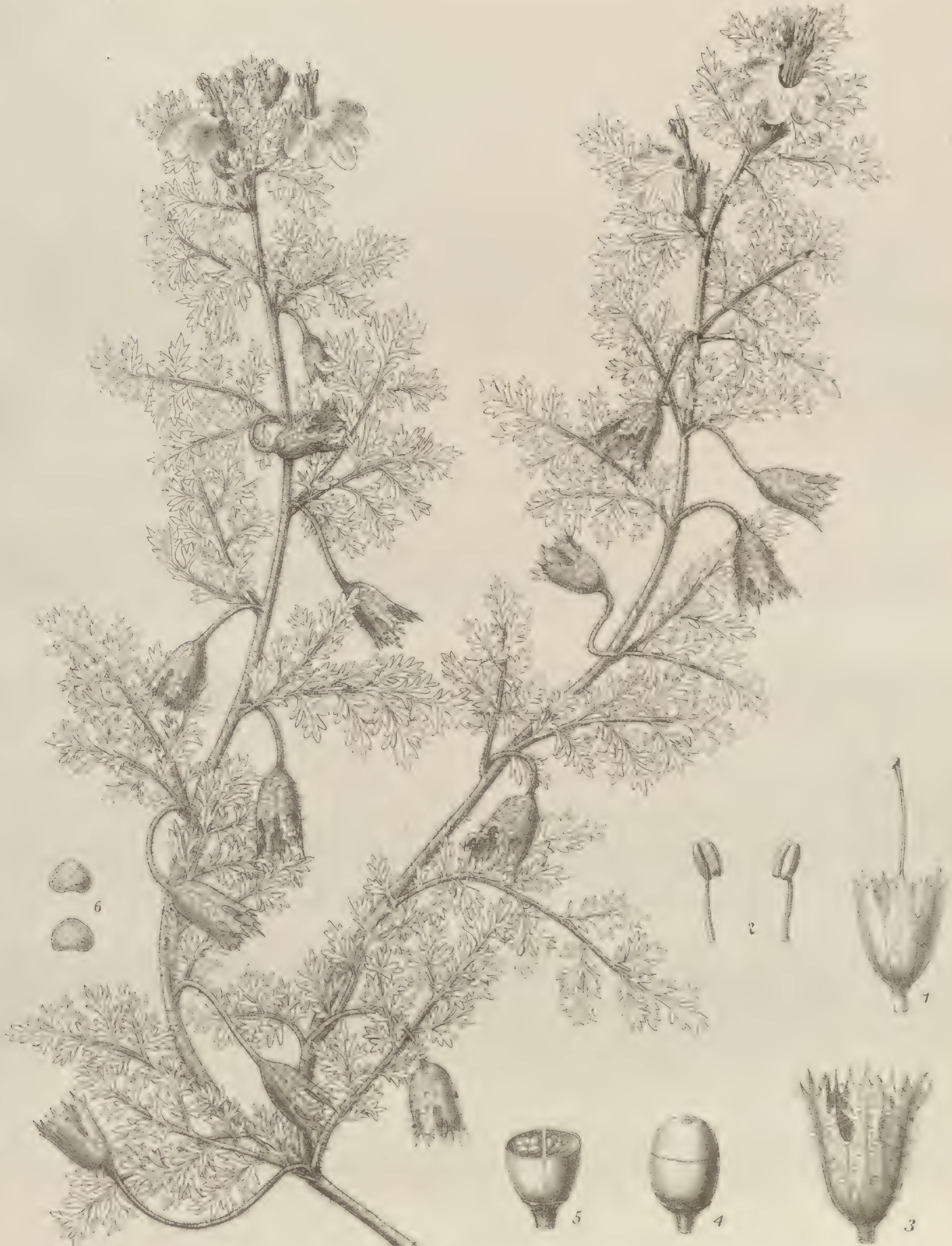
W. B. Hemsley dir.

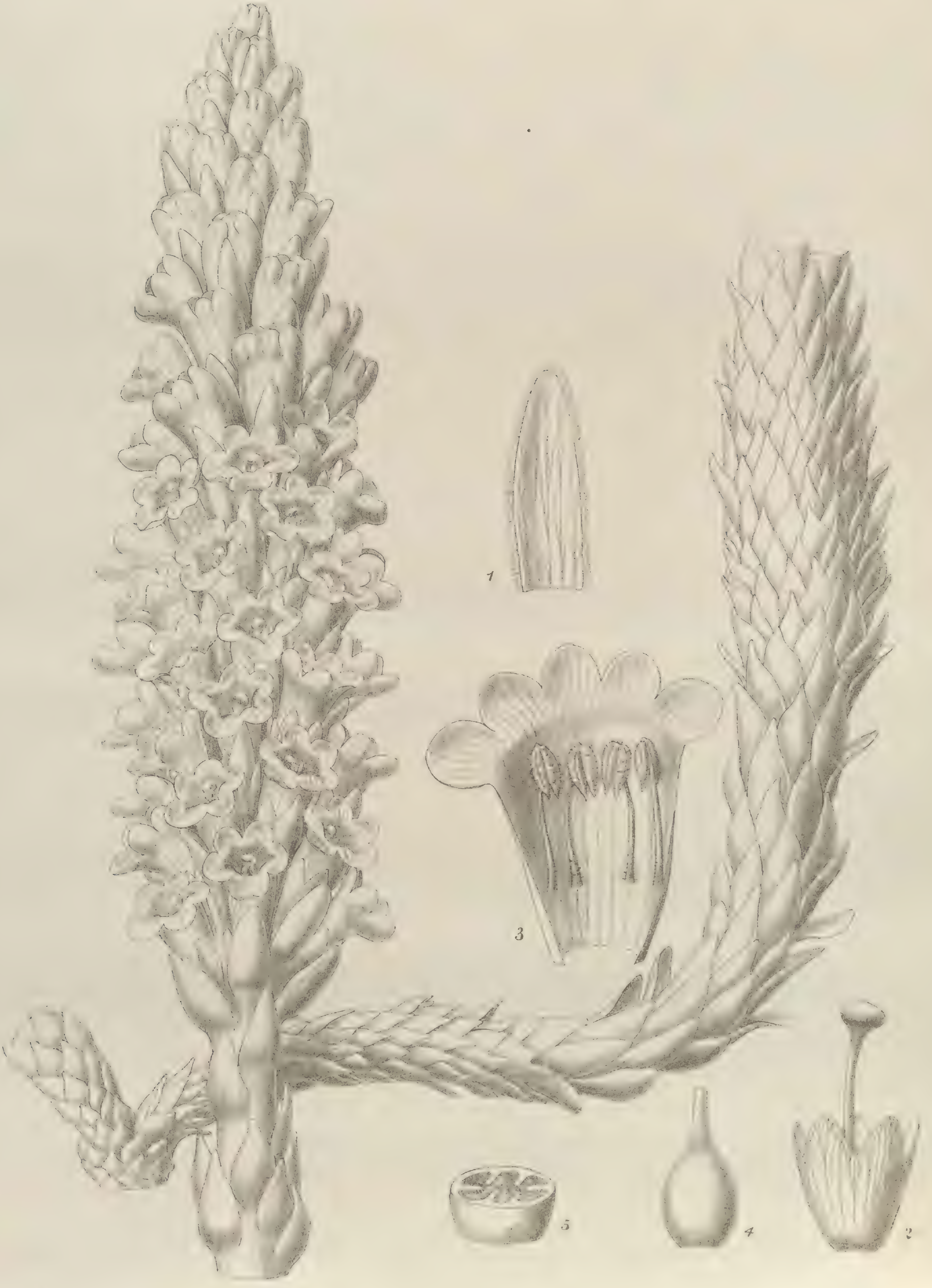
Hanhart imp.

APOCYNUM VENETUM, *Linn.*



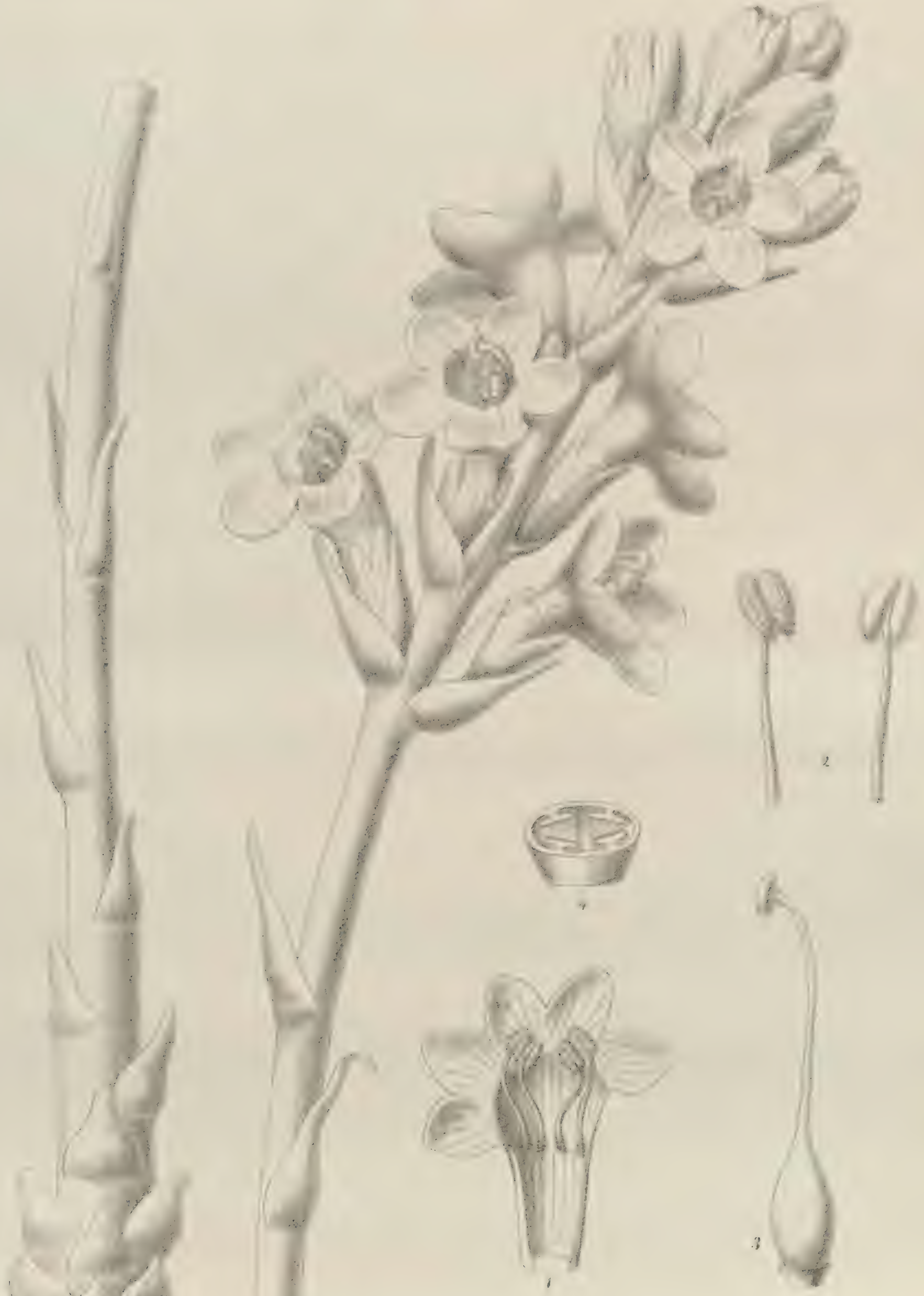
M. Smith del. J. Allen lith.
W. B. Hemsley dir.
Hanhart imp.

HYOSCYAMUS SENECIONIS, *Willd. var.* MULTIFIDUS, *Aitch. et Hemsl.*



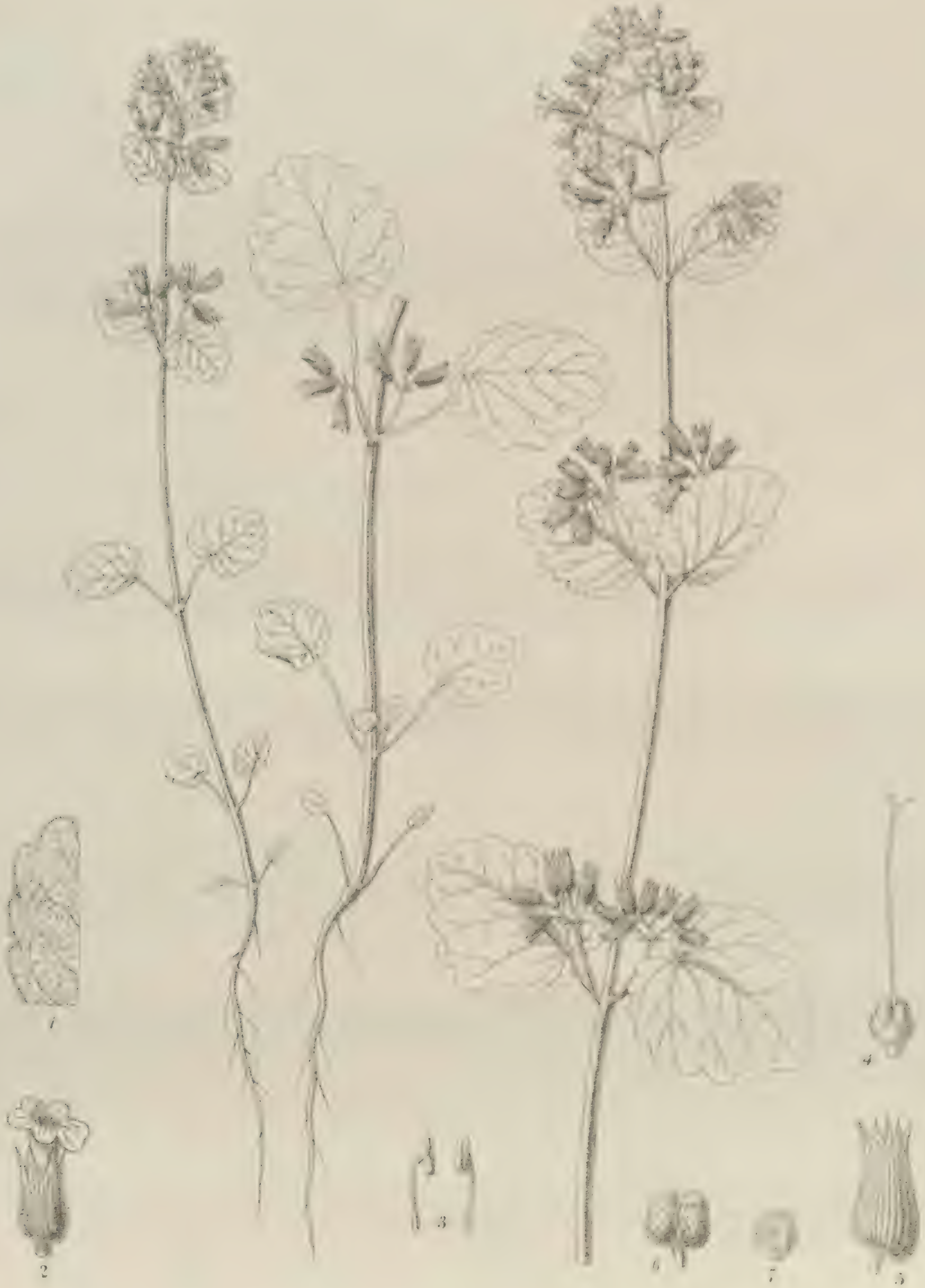
M. Smith del. J. Allen lith. W. B. Hemsley dir. Hanhart imp.

CISTANCHE RIDGEWAYANA, *Aitch. et Hemsl.*



M. Smith del. J. Allen lith. W. B. Hemsley dir. Hanhart imp.

CISTANCHE LAXIFLORA, *Aitch. et Hemsl.*

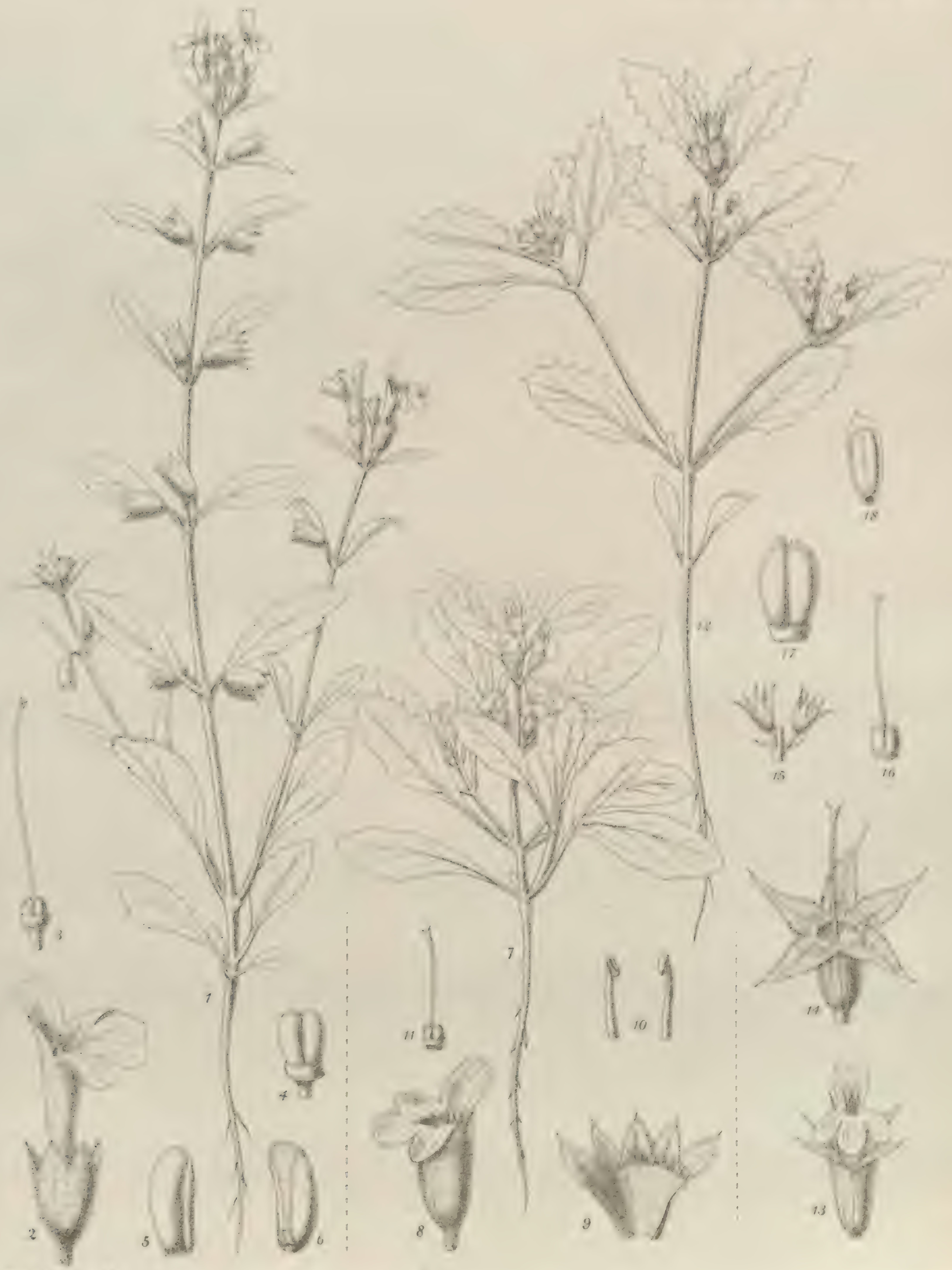


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

Hanhart imp.

NEPETA SEWERZOWII, *Regel*.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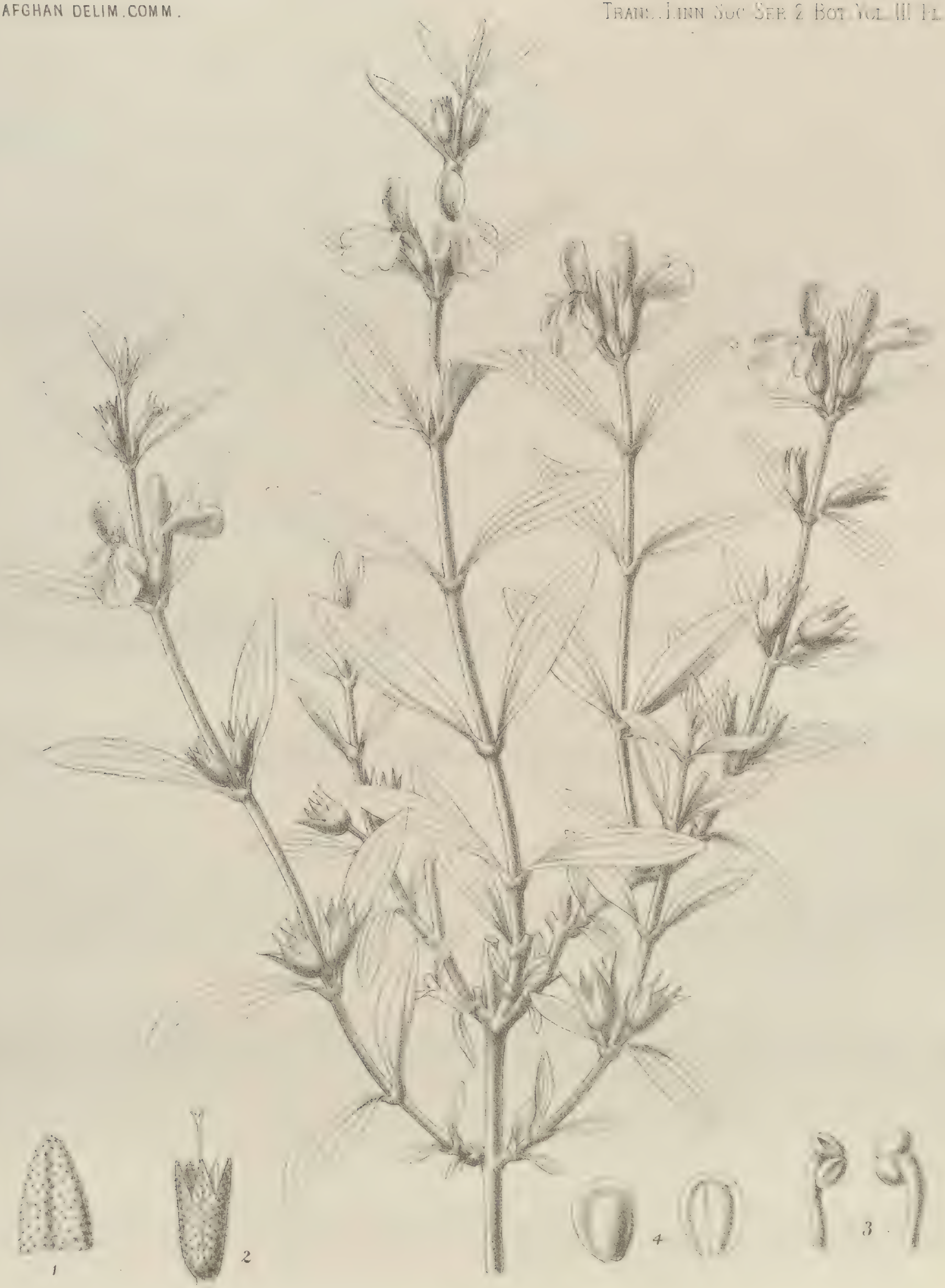
M. Smith del. J. N. Fitch lith.

W. B. Hemsley dir.

Hanhart imp.

1-6 CHAMÆSPHACOS PERSICUS, *Aitch. et Hemsl.*
7-11 " AFGHANICUS, *Aitch. et Hemsl.*
12-18 " ILICIFOLIUS, *Schrenk.*

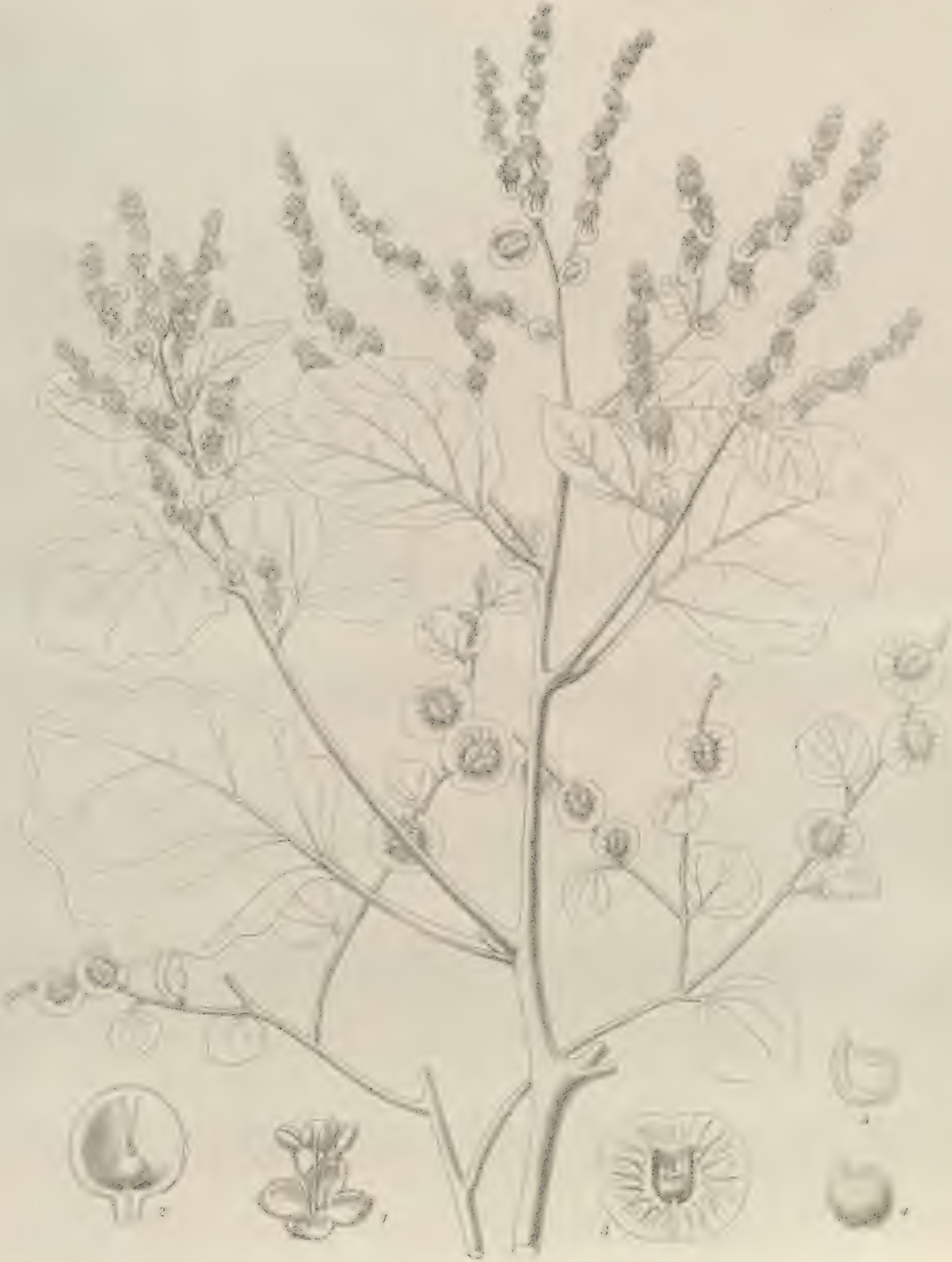


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

Hanhart imp.

STACHYS TRINERVIS, *Aitch. et Hemsl.*

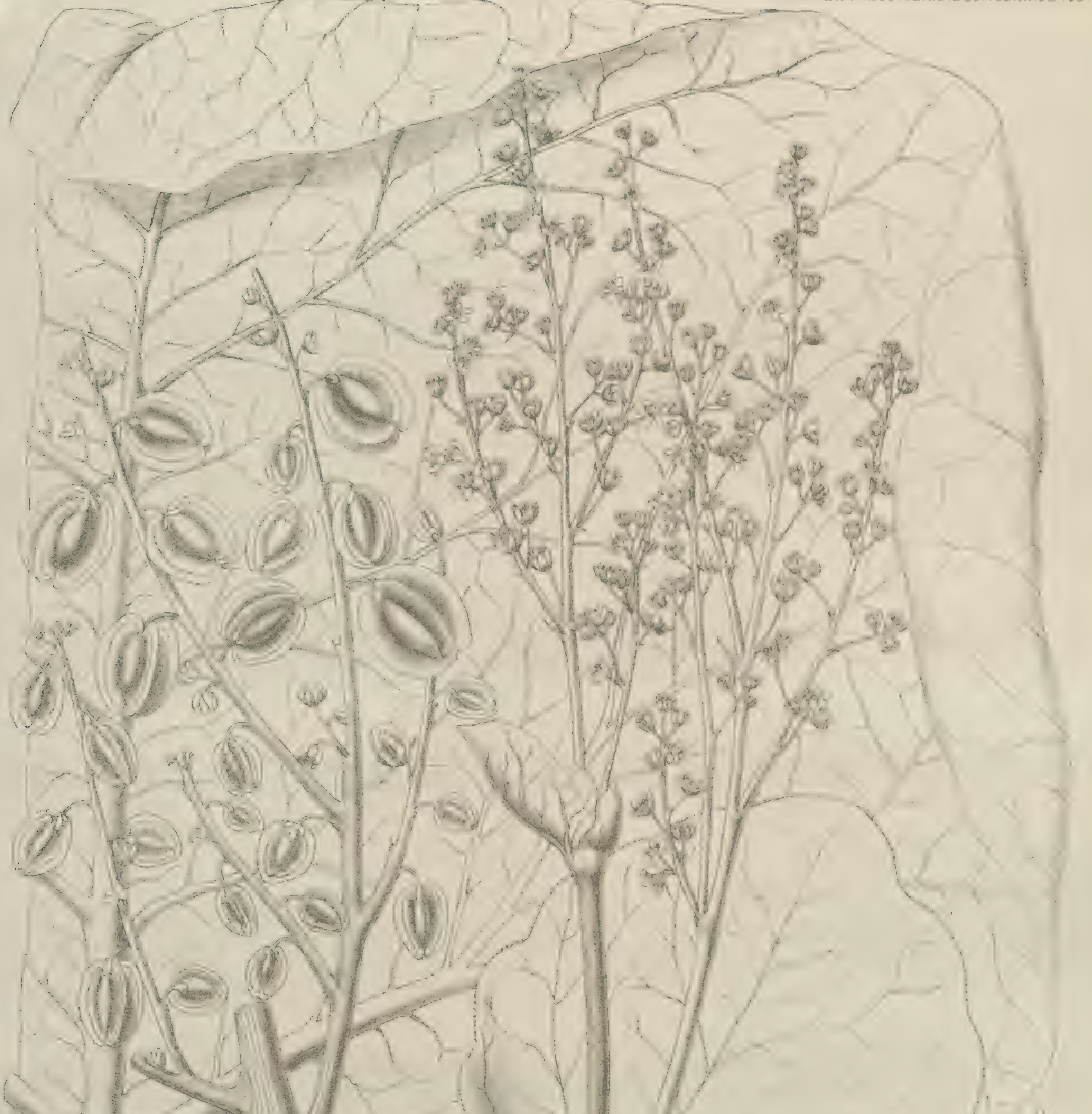


M. Smith del. J. Allen lith.

W. B. Hemsley dir.

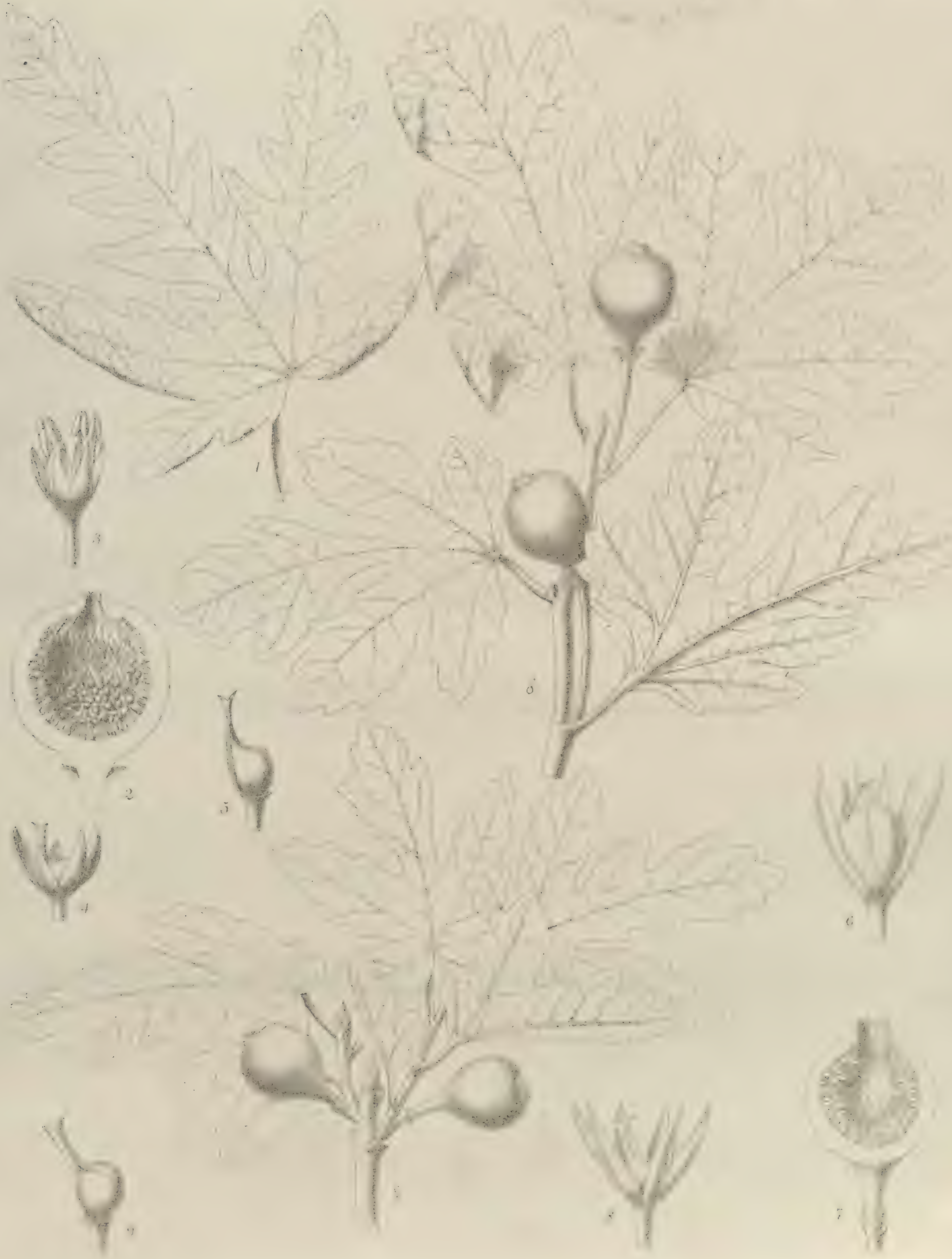
Hanhart imp.

ATRIPLEX MONETA, *Bunge*



M. Smith del. J. Allen lith. W. B. Hemsley dir. Hanhart imp.

RHEUM TATARICUM, *Linn. f.*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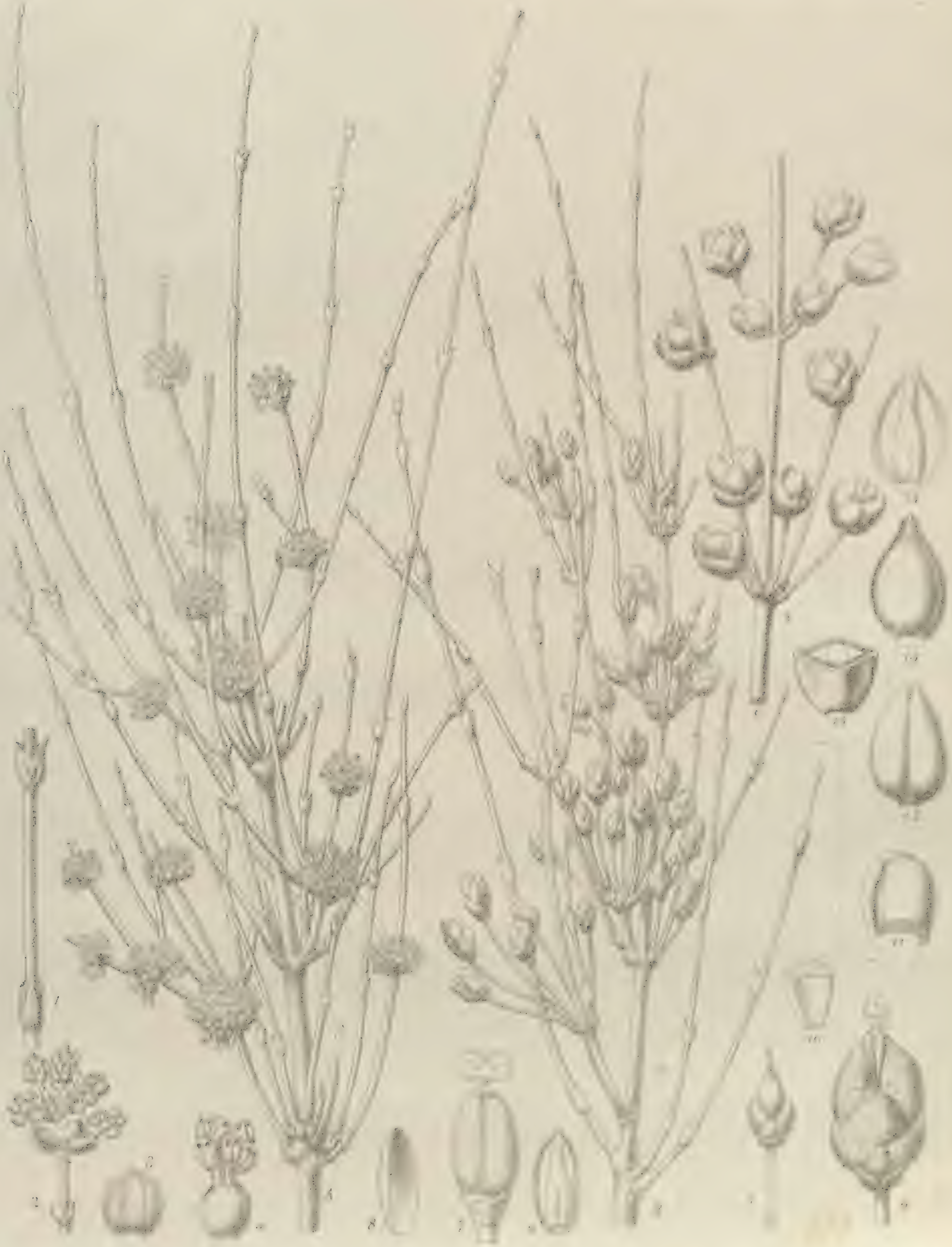
W. B. Hemsley dir.

Hanhart imp.

FICUS CARICA, *Linn.*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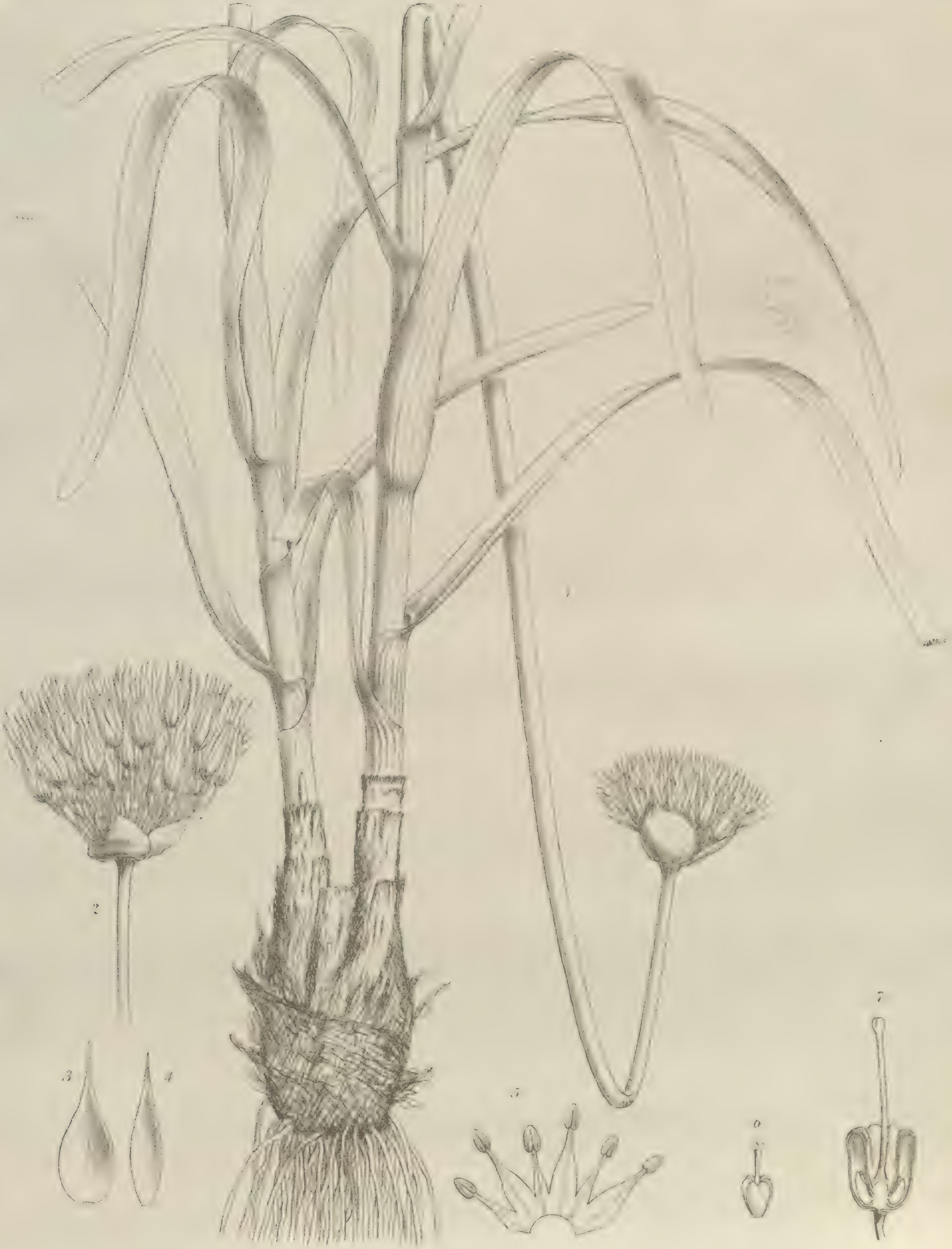
M. Smith del. J. Allen lith.

A B. Figs, 1-10 EPHEDRA PACHYCLADA, *Boiss* ?
C. „ 11-15 „ SARCOCARPA, *Aitch. et Hemsl.*



W. B. Hemsley dir.

J. Allen del. et lith.

ALLIUM XIPHOPETALUM, *Aitch. et Baker.*

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	Part VI. 1884.	0	13	6	0	10	0
	Part VII. 1884.	0	9	6	0	7	0
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	Part IX. 1886.	0	7	0	0	5	0
	Part X. 1887.	0	3	4	0	2	6
	Part XI. 1886.	0	6	0	0	4	6
	Part XII. 1886.	0	8	0	0	6	0
	Part XIII. 1887.	1	7	0	1	0	0
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	Part XV. 1887.	0	10	0	0	7	6
III.	Part I. 1888.	3	12	0	2	14	0

2nd Ser. BOTANY.] [VOL. III. PART 2.

THE TRANSACTIONS OF THE LINNEAN SOCIETY OF LONDON.

ON THE LIFE-HISTORY OF A REMARKABLE UREDINE ON JASMINUM GRANDIFLORUM, L. (*UROMYCES CUNNINGHAMIANUS*, nov. sp.).

BY

A. BARCLAY, M.B., Bengal Medical Service.

(*Communicated by* G. MURRAY, F.L.S.)

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II. *On the Life-History of a remarkable Uredine on* Jasminum grandiflorum, *L.* (Uromyces Cunninghamianus, *nov. sp.*). *By* A. Barclay, *M.B., Bengal Medical Service.* (*Communicated by* G. Murray, *F.L.S.*)

(Plates XLIX. & L.)

Read 16th January, 1890.

While on a visit to the small village of Sairi, twelve miles from Simla, but at a considerably lower elevation than the latter (about 4000 feet above the sea-level, Simla being about 7000 feet), I found on the 28th and 29th August, 1886, several bushes of *Jasminum grandiflorum,* a wild plant growing in great profusion on the outskirts of the village, largely attacked by an æcidial fungus, which apparently at that time was nearly over, but has since proved to be one of exceptional interest. In 1887 I obtained the first specimens from nature on the 15th July—a few leaves with a few immature patches. The æcidial patches were bright yellow, and were found on the flowers, leaves, and stems; but especially frequently on flowering heads, which were then very considerably distorted and hypertrophied. The patches on the leaves varied in size from a minute point to 4 to 5 millim. in diameter and even more (Pl. XLIX. fig. 13, and Pl. L. fig. 1); but some were larger and without definite shape, probably formed by the early coalescence of originally distinct foci of attack. One such irregular patch over the middle of a leaf, involving the mid-rib, measured for example 13 millim. in length by 8 millim. in breadth, and was deeply concave above. The patches were mostly circular, reddish in colour above, and yellow below, and were bulged either upwards or downwards, though more frequently convex above.

The peridia break through from both surfaces of the leaf, but most frequently from that surface which is convex. A single leaf bears usually from one to three patches, but as many as sixteen were counted in exceptional cases. I should here mention that only the young shoots of the present season's growth are attacked, and never the older ones; and the youngest and most tender leaves and shoots are the most extensively attacked.

The æcidial patches on young stems or petioles involved either the whole structure uniformly (Pl. XLIX. fig. 14), and in that case the whole stem or petiole was uniformly hypertrophied, or the mycelium attacked only one side, forming well-defined tumours, resembling those I have described in *Æcidium Urticæ* [*], though not nearly so large (Pl. XLIX. fig. 3). The amount of hypertrophy and distortion caused was often very considerable, and the frequent attack of young buds, which were thereby destroyed, is worthy of notice. The peridium, which is white, bursts at its summit stellately, allowing the orange-red æcidiospores to fall out.

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[*] 'Scientific Memoirs by Medical Officers of the Army of India,' part ii. pp. 29, 38, 1886.

At the same time I observed that several of the patches on all the above-named parts were dark-brown instead of being reddish yellow. I at first thought these were simply shrivelled-up old æcidial patches, but an examination of them with a field lens showed that although they were evidently old æcidial patches, the peridia were not collapsed or empty, but filled with dark brown spores. I therefore carefully collected a number of these dark patches, and on my return to Simla submitted them to microscopic examination, which revealed the extraordinary fact that the old æcidial cups (peridia) now contained masses of single-celled teleutospores (*Uromyces*). Although I looked most carefully for uredo pustules, I never found any, so that I had apparently an autœcious Uredine before me, in which the formation of uredospores has been entirely thrown out, without any detriment to the diffusion of the fungus, for this was extraordinarily abundant on affected bushes.

During September the further formation of æcidia ceases, and the peridia, becoming filled with teleutospores, remain dormant until the next rainy season sets in, *i. e.* for nearly nine months, for the *Æcidium* is produced only during very moist weather.

When I first found this fungus the season was too far advanced to attempt any cultivation experiments, but I preserved the teleutospores I had gathered for use during the following year, and I lost no time in at once observing the mode of germination of the æcidiospores. And this also, as will be more fully explained later, showed that the fungus was remarkably unlike any other *Æcidium* hitherto described.

From the fact that the teleutospores are formed within the peridia, and only there, it was almost certain that the parasite was an autœcious one, but it was nevertheless desirable to put this question to experimental test, and thus beyond all doubt. I consequently began early next spring to lay the teleutospores I had gathered and preserved during the winter on the leaves of wild plants collected in the woods about Simla, and which I supposed were of the same species. To my great disappointment, none of these experiments succeeded, although cultivation showed that the teleutospores had retained their vitality perfectly, germinating in water with great freedom. I at first attributed my failure solely to the fact that my inoculations were all practised at that early time of the year on old leaves, whilst, as I have already stated, in nature only the newly unfolded leaves are attacked. At the same time I never felt certain that the host with which I experimented was identical with the host I found bearing the *Æcidium* at Sairi, although superficially there appeared to be no difference between them, except that the leaves of the latter are thicker than those of Simla plants. I therefore sent specimens of the host I was experimenting with to my friend Dr. D. Prain, of the Calcutta Botanic Garden, who confirmed my doubt by naming the species *J. officinale*, L. Fortunately, very early in spring I collected some cuttings from bushes of Jasmine near Sairi, and two of these took root in pots kept in a sheltered place. These cuttings were carefully selected and were quite free from any previous attack. They put out a few delicate new shoots early in August, which unfolded several leaves later. The cuttings had been carefully protected from exposure to normal attack, although there was little need for this precaution, as the parasite does not occur in Simla, keeping well to the deep valleys below. Upon these leaves a few teleutospores were placed, and to my great pleasure two typical æcidial patches were produced, which, after running a normal course, went on to the formation of teleutospores in the cups which had originally borne æcidiospores, thus completing the whole cycle of development.

Owing to the unfortunate mistake I made in confusing *Jasminum officinale* with *J. grandiflorum*, I had no further opportunity of confirming this single experiment by others, the season for experiment having passed by. During the following year (1888) I was absent from India, and the investigation had to lie over until my return. Since then I have succeeded in numerous instances in producing æcidial patches with sporidia, and this relationship is established beyond all doubt. The mistake, however, which I made in confusing hosts is not without interest, showing how extremely selective some species of the Uredineæ are in the choice of their hosts. *J. officinale* is very nearly related to *J. grandiflorum* *, and yet numerous and prolonged efforts to produce the *Æcidium* on it failed entirely. I may also mention that another species of Jasmine, *J. humile*, L. †, harbours an entirely different *Æcidium*. So that the three common species of Jasmine in this neighbourhood are sharply distinguishable from one another as hosts of the Uredineæ. A knowledge of this fact, it is conceivable, might be of use to systematists in deciding the specificity of a disputed plant. Should the question arise whether our common Simla *J. officinale* is merely a variety of *J. grandiflorum*, the fact that a well-defined parasite will readily select the one to grow upon, while it will have nothing to say to the other, would possibly influence a decision.

I had personally met with the parasite only at Sairi, but a servant of mine, living in a low-lying valley near Simla, but in a different direction, seeing me interested in this "blight," brought me several shoots collected near his village, as densely attacked as any I had seen at Sairi. The fungus appears therefore to be common in the deep valleys about Simla, *i. e.* at elevations of about 4000 to 5000 feet, though it never comes up to the elevation of Simla. I have not been able to ascertain the extent of its distribution downwards towards the plains; but at one village at the foot of the hills, where this species of Jasmine is abundant, I saw no trace of it. It would thus appear, on the insufficient data available, that in vertical distribution this fungus is remarkably limited.

Transverse sections through affected portions of the stem show that mycelial invasion is mainly limited to the cortical parenchyma; but at a few points some hyphæ may be seen entering the margin of the central pith by way of the medullary rays (Pl. L. fig. 2).

The main seat of invasion is therefore the cortical parenchyma, and this tissue, when invaded, is greatly hypertrophied. In the transverse section of an affected stem about 3·25 millim. in diameter, I noted that whilst the depth of the normal layer of cortical tissue, from the epidermis to the margin of the central circle of fibrovascular bundles, was 0·25 millim., it was from 0·88 millim. to about 1 millim. opposite the centre of the teleutospore beds. Further, in the unaffected parts of this tissue isolated small fibrovascular bundles (leaf-traces) may be seen, but in affected areas these have almost entirely disappeared; so that between the bases of the fruit-bodies (peridia) and the central fibrovascular system there is a uniform mass of hypertrophied cortical parenchyma cells. These cells are much enlarged, for whilst the normal cells in transverse section measure about $29 \times 19\,\mu$ or $16 \times 12\,\mu$, the cells amongst the mycelium measure up to $76 \times 63\,\mu$ or even more. These hypertrophied cells, in transverse section, are round or oval in outline; but between æcidial cups they are elongated, measuring about $113\,\mu$ in length by $31{\cdot}5\,\mu$ in breadth (Pl. XLIX. fig. 15). Between these elongated cells the mycelial filaments may be seen in great abundance. Although the mycelium gains entrance sparingly into the central parenchymatous tissue of the stem, it is not perennial.

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* See descriptions in Sir J. D. Hooker's 'Flora of British India,' iii. p. 603.

† 'Journal of the Asiatic Society of Bengal,' vol. lvi. pt. II. p. 363 (1888).

When sections are made through young æcidial patches, all the peridia will be found to contain æcidiospores only; but in somewhat older patches it will be seen that, whilst the central peridia contain teleutospores, the marginal ones contain only æcidiospores, and a few intermediate between these will be seen to contain both, though in the last case neither spores in their fullest development (Pl. XLIX. fig. 16) When the production of æcidiospores ceases within a given peridium, the whole layer of basidia appears to be forced upwards by the developing bed of teleutospores—in other words, there is no concurrent growth of æcidiospores and teleutospores in any peridium; but, on the other hand, there is no pause between the cessation of the production of æcidiospores and the development of teleutospores. The exact way in which a substitution of teleutospores for æcidiospores takes place is as follows:—When a sufficient number of æcidiospores has been formed in a given peridium, the centre of the hymenium producing them is upheaved, and very shortly broken through by the developing teleutospores. A section through the middle of an æcidial cup at this time shows, therefore, a crop of young immature teleutospores, flanked on either side by old æcidiospores (Pl. XLIX. fig. 16). The crop of teleutospores increases very rapidly radially, and so quickly throws off the whole hymenium which bore the æcidiospores that in many sections, while a more centrally placed peridium in a patch may be seen bearing teleutospores only, the adjacent peridium may still be full of æcidiospores. Thus teleutospore formation is not only centrifugal in each peridium, but is also so in respect of the whole of the peridia on a patch of invasion.

The teleutospores are much greater in size than the æcidiospores, and the peridia, when they come to contain them, increase much in breadth. A young æcidial cup filled with ripe æcidiospores was found to measure 0·189 millim. in diameter, and one in the same preparation, containing old æcidiospores, 0·315 millim. in depth and width, whilst an old cup with mature teleutospores measured 0·31 millim. in depth and 0·548 millim. in width. These measurements show, therefore, that there is also a centrifugal development in each peridium from first to last.

In addition to this difference in shape, the peridium filled with teleutospores differs also markedly in having a hymenium consisting of long parallel stalks, about 95 μ in depth, instead of the short basidia of the æcidiospores (Pl. XLIX. figs. 15 and 17).

SPERMOGONIA.—Spermogonia are present as usual in the early stages of development of the first crop of æcidial patches—that is, those produced by the sporidia; but they are by no means numerous, and soon all traces of them disappear. These structures are entirely absent from the patches formed later by the æcidiospores. I have never seen them in any of the numerous sections I have made through secondarily produced æcidial patches. They are of the usual form and structure, with a tuft of paraphyses protruding through their mouths to the extent of about 44 μ. The spermogonium measures about 145 μ in depth and width. Before these organs are produced considerable hypertrophy has already taken place in the host's tissues. For example, the normal thickness of the leaf-blade was in one case found to be 157 μ, whilst in the spermogonial stage it was 409·5 μ and in the æcidial 567 μ. They are usually borne on the lower or convex side of the leaf-patch.

PERIDIUM.—This consists of a single layer of cells, each thickened on one side, the outer side, and bevelled at the upper and lower ends (Pl. XLIX. figs. 5 and 18). The upper bevelled end of each cell overlaps the lower end of the cell immediately above it. The cells measure about $26 \times 19\,\mu$, the thickened outer side being 3 to 4 μ in depth.

ÆCIDIOSPORES.—These are round, or more rarely oval, pale yellow bodies, abstricted serially in rows as usual, and measuring on an average 16 μ in diameter. Externally they are beset with minute tubercles (Pl. XLIX. fig. 4). When placed in water they germinate freely, immediately after ripening, the contents within a few hours becoming vacuolated prior to the emergence of germ-tubes (Pl. XLIX. fig. 5). The subsequent phenomena are, however, very remarkable, and unlike those of any other æcidiospores with which I am acquainted. The germ-tube, which is quickly emitted, soon acquires the appearance of a promycelium, as in the case of *Endophyllum*, but does not actually assume the character of one, as it never produces sporidia. After the germ-tube has attained a length of about 35 μ it divides into two nearly equal parts, and each part now forms a long sterigmatous branch (Pl. XLIX. figs. 6, 7). That from the upper cell emerges almost always from the extreme end of the germ-tube, but sometimes from a point to one side of the end; whilst that from the lower cell emerges usually from a point a little below the septum. The exact position of this lower sterigmatous branch is, however, more variable: it sometimes emerges from a point near the spore, sometimes from a point just under the septum. The length of these sterigmatous tubes varies greatly: in one case the upper was found to be about 60 μ long and 2 μ in diameter, while the lower one was a little longer. The coloured contents of the spore wander into the germ-tube, and the empty spore-walls are then readily seen to be studded with minute tubercles. I carefully observed many water cultivations, but never saw, either there or upon a leaf-surface, any sporidia formed at the ends of these sterigmatous branches. These sterigmatous branches enter directly into the tissue of the host, and there form another mycelium, commencing the life-cycle over again.

TELEUTOSPORES.—These are brown single-celled bodies (*Uromyces*), usually distinctly thickened at the free end, through which a germ-pore may often clearly be seen. They may be scraped off their beds without much difficulty, breaking off with a portion of stalk adhering to them. On an average they measure, when just moistened, 36×20 μ but individual measurements varied from 26×24 μ to 44×18 μ. The mean thickness of the wall of the spore is 2 μ, but at the free end where it is thickened it measures 6 to 8 μ. Most of the spores are oval and symmetrical, but a few are asymmetrical, with the thickening to one side. In some a nuclear space is clearly defined in the midst of granular protoplasm. The spores, as a rule, do not germinate immediately after ripening, although in a very few cases I did observe such germination. After a winter rest, however, they germinate freely in water, emitting a promycelium of the usual characters, dividing by septa into three cells usually, but sometimes four. I have observed the germination of these spores from early spring to July, when in nature they attack the newly-formed leaves. In April they germinate feebly and slowly; in May still only a few germinate, and that slowly; even in June some halting in germination may be observed; but in July germination is very speedy.

The diameter of the promyceliun is about 8 μ. Each cell usually produces a sporidium at the end of a sterigma, which is about 14 μ in length and 2 μ in diameter. The sporidium is oval, and very often displays two vacuoles, one at each end; it measures from 12×8 μ to 14×10 μ. The sporidia germinate quickly, forming secondary sporidia, sometimes even before they become detached from the promycelium (fig. 12, Pl. I.). The germ-tube of the primary sporidium is somewhat stouter than the sterigma, measuring usually 3 μ in diameter. The secondary sporidium is generally about the same size as the primary; in one case, carefully measured, it was found to be 14×10 μ, exactly the same as the primary sporidium which gave rise to it. I noticed that very soon after the æcidial attack had established itself the old teleutospores of the previous year lost vitality, and were no longer capable of germinating—*i. e.* during September.

Since my return to Simla, in 1889, I have been able to confirm the one successful experiment, above mentioned, in which the æcidium was produced with sporidia. On the 5th June I placed some sporidia on the young tender leaves of two plants, (*a*) a twig cut off under water and kept in a glass box outside, and (*b*) a small rooted plant in a pot kept under a glass shade in my laboratory. The sporidia were obtained thus:—Some teleutospores were scraped off on the 3rd June, and floated on water in a watch-glass, which was then kept in a moist atmosphere. On the 5th a fairly large number of sporidia could be seen with a microscope. This water was placed on the leaves of the two plants. On the 12th (7 days), (*b*) showed two leaflets distinctly attacked, and a few days later seven distinct centres of attack. Unfortunately the plant got injured, and the shoot bearing these æcidial patches died off on the 4th July, just as a number of æcidia were about to emerge. The leaves of (*a*) similarly disclosed several foci of attack, which, however, did not proceed to any æcidial formation, as, being merely cut twigs, they withered soon after initial patches were formed. Again, on the 15th June, I placed sporidia similarly obtained, and in the same way, upon a potted plant in a glass forcing-box outside, and on the 21st (6 days) eighteen distinct foci of attack could be counted. These went on in due course to complete development. Again, I inoculated similarly a small plant growing in the open air, in my garden, on the 5th July, and on the 10th I noticed several distinct spots of attack, which ultimately ran a normal course. Attack is therefore very rapid. I could give the details of other experiments; but these are, I think, sufficient to prove that the parasite is autœcious.

The next question in the life-history of the fungus, which presents itself for consideration, is the fate of the æcidiospores. It was of course probable that they re-attacked the same host, and experimental evidence shows that this is the case. And, indeed, the natural history of the fungus pointed strongly to this result, for after a plant has become attacked in the first instance by sporidia from over-wintered teleutospores, and some æcidial patches have been thus formed, the subsequent spread of the fungus is extraordinarily rapid, leading irresistibly to the conclusion that it must have been due to attack by the numerous æcidiospores liberated. Here, then, we have a marked case of the assumption by æcidiospores of the function of uredospores, and the consequent non-necessity for the production of the latter. We have, therefore, two directions in which we may look for the throwing out of uredospores from the developmental history of the Æcidiomycetes, namely (*a*) where the power of immediate germination of the teleutospores secures a wide distribution, as I have explained elsewhere in the case of *Æcidium Strobilanthis* *, and (*b*) where, as in the present case, the æcidiospores assume this function. On the 23rd July I dusted some recently unfolded leaves of Jasmine on a twig, the end of which had been cut off under water, and then kept in a moist atmosphere under a glass shade in my laboratory, with æcidiospores. On the 30th I noticed several distinct spots of attack. As these could not go on to complete development, I dusted some leaves on the latter date, both young and old, of a potted plant outside with æcidiospores, and covered the whole with a glass shade. On the 3rd August very numerous spots of attack could be detected on all the young leaves, and all these went on to further complete development. Attack, then, with these spores is even more rapid than with sporidia. The most striking thing in such experiments with æcidiospores is the immense attack of the host (Pl. L., fig. 1), and the extreme rapidity with which it takes place. But although the young leaves were thus largely attacked, the older darker leaves resisted completely. I could give the details of other experiments in this direction also, but they would be, I think, superfluous.

In conclusion, I will offer a few remarks suggested by the peculiarities of this fungus. These are mainly three: (*a*) the production of teleutospores within the peridia; (*b*) the assumption of a distributive function by the æcidiospores; and (*c*) the very peculiar germination of the æcidiospores.

The unusual site of teleutospore-formation forms a link with *Puccinia Berberidis*,

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* 'Scientific Memoirs by Medical Officers of the Army of India,' pt. ii. p. 20.

Montagne, where, as figured by de Bary *, these spores are formed immediately outside the peridium by the same mycelium. This suggests the view that primarily teleutospores were always formed within peridia, and that in course of evolution they were thrust immediately outside (*Puccinia Berberidis*), then further away (*Uredo Behenis*, &c.), and lastly were produced on separate mycelia, as happens at the present time with the great majority of these fungi.

The assumption of a distributive function in so marked a degree by the æcidiospores is, I believe, illustrated for the first time by this species. It renders the production of uredospores superfluous, and we have consequently none.

With regard to the third peculiarity, that, namely, of the germination of the æcidiospores, this naturally suggests affinities with *Endophyllum*. If the latter may be regarded as a starting-point in the evolution of the Uredinæ, we have here a connecting-link with others. Instead of the æcidiospore forming a regular promycelium, with sporidia, we have, so to speak, an abortive promycelium, stopping short of the production of sporidia, but attacking with a sterigmatous branch, the result being alike in both cases, the immediate reproduction of a similar spore. In the case of *Endophyllum*, however, the mycelium is perennial, whilst it is certainly not so in the species under consideration. Instead of persisting through an unfavourable time in mycelial form, the latter produces, as we have seen, a resting spore, which must be regarded as an advance, inasmuch as the production of such a spore must be both more economical and more certain for the preservation of the species than a perennial mycelium. Assuming for the moment that the Uredineæ have started from a form like *Endophyllum*, then it is conceivable that an evolutionary course something like the following may have taken place :—

1. First stage æcidiospores only, but behaving like teleutospores in producing sporidia; preservation of species by perennial mycelium. (*Endophyllum.*)
2. The same: but with a view to a more economical method of preserving the species, the formation of a second kind of spore with resting properties. The production of sporidia, which only wastes time as far as a distributive function is concerned, is being relegated to the teleutospore. (The species now under consideration would be an example.)
3. A more marked separation of distributive and preservative function in these two forms of spores, the latter still continuing to assist in distributing, but mainly subserving a preservative function (teleutospores which germinate at once after maturing, as well as after a rest, e. g. *Æ. Strobilanthis*).
4. A complete separation of these functions, with the production of a third form of spore (uredo) to aid in distribution. (Including the majority of species whose life-histories are known.) Here, except for special reasons (mostly unknown), a perennial mycelium becomes unnecessary.

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* 'Botanische Zeitung,' 1879, no. 48, t. 10.

5. At first the same portion of the same mycelium produces both spores (the species under consideration).
6. Later, on the principle of the physiological distribution of function, separate portions of the same mycelium form the separate spores (through *P. Berberidis* to the more ordinary forms).
7. Later still, to aid in the struggle for existence, where the distribution of species becomes important, separate mycelia produce separate spores (most autœcious species).
8. With increasing struggle for existence, heterœcism with increased necessity for aid in distribution, *i. e.* for the production of uredospores (most heterœcious species).

But, as I have said, there are grounds for thinking that *Endophyllum* should not be regarded as the starting-point in this evolution. If the æcidial fructification had been the most essential, it is not probable that it would have been thrown out in any species; and yet in *Puccinia Collettiana*, as I have shown *, and as others have shown, I believe, in other cases, this has happened, and no vestige of it is left. Indeed, as Dietel points out †, the only spore-form, which, as far as we know, is invariably present, is the sporidium, the product of a teleutospore, and Brefeld has advanced strong arguments for regarding every other form of spore as subsidiary.

Endophyllum, in this view, must be regarded as an aberrant branch, and it would perhaps be more correct to look upon the Jasmine æcidium as tending in the same aberrant groove. It is conceivable that, if the mycelium acquired a perennial habit, as has been acquired by *Endophyllum*, the formation of teleutospores would become unnecessary, and would therefore cease to be formed. In that case our fungus would become practically an *Endophyllum*.

It is worthy of remark that in this species the sporidium and the æcidiospore are physiologically almost equivalent, as each produces a like mycelium, with this difference only, that while the mycelium produced by a sporidium bears spermatia, that produced by an æcidiospore does not. As this is the second Uredine in which I have observed this peculiarity I would draw particular attention to it. I first noticed it in the life-history of *P. Collettiana* ‡. In this species also the sporidia form mycelia bearing spermogonia; but the mycelia produced by primary uredospores, though like the former mycelia in every other respect, bear no spermatia. If further investigation should show that the same occurs in all similar cases (members of the groups *Brachyuromyces*, *Brachypuccinia* and *Uromycopsis*, *Pucciniopsis*, Schröter), this would give additional support to Brefeld's view that spermatia and sporidia are spores of a like kind (conidia) differing from the remaining forms of spores in this order (chlamydospores).

The whole life-cycle of the species under consideration may begin with the æcidiospore, ending with a sporidium, or, beginning with a sporidium, end with a teleutospore;

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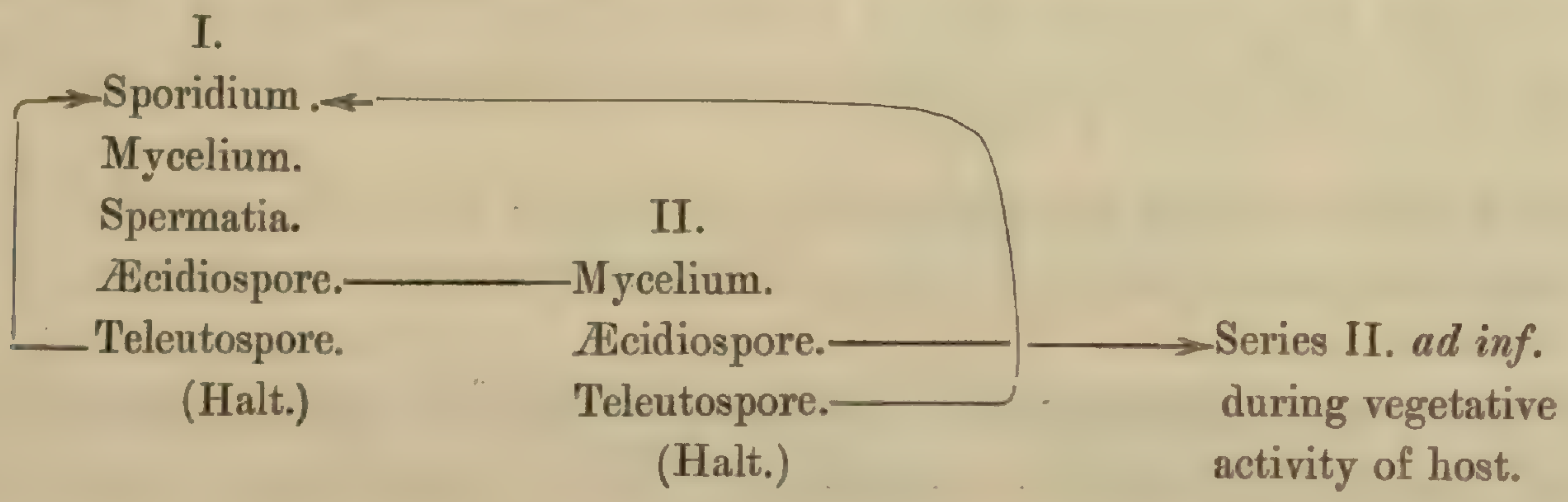
* 'Scientific Memoirs by Medical Officers of the Army of India,' pt. v. 1890, pp. 87–91.

† "Beiträge zur Morphologie und Biologie der Uredineen," a series of seven papers in the 'Botanisches Centralblatt,' xxxii.

‡ *Loc. cit.*

but in the cycle beginning with an æcidiospore no spermatia are formed. The cycles may be represented graphically thus:—



We have here, then, a new species, with very distinctive features, and I propose naming it *Uromyces Cunninghamianus*, after my friend Dr. D. D. Cunningham, F.R.S., whose beautiful researches in India in this as in other branches of botanical science are well known. Of the several groups into which the *Uromyces* have been divided, this species would come most nearly under *Uromycopsis*, Schröter; but it bears no trace whatever of uredospores.

UROMYCES CUNNINGHAMIANUS, n. sp.; æcidiis in soros orbiculares aggregatis, hypophyllis vel caulicolis, orbicularibus, minutis, 4–5 mm. diametro, inferne rubro-aurantiacis, superne rubris; æcidiosporis albo-luteis orbicularibus vel ellipsoideis, 16 μ diametro, tuberculatis; pseudoperidiis albis, apice stellatim dehiscentibus, et strato uno cellularum externe incrassatarum compositis, 26×19 μ; spermogoniis 145 μ; uredosporis defectis; teleutosporis vero in æcidiorum soris erumpentibus demum omnino eorum sedes possidentibus, atro-fuscos in soros congestis, ellipsoideis, fuscis, apice libero incrassato, levibus, se cum pedicelli fragmento avellentibus, 26×24–44×18 μ; sporidiis ovalibus, 12×8–14×10, sæpe sporidia ipsis gerentibus.

The æcidia are produced only on newly unfolded leaves, and the mycelium causes considerable hypertrophy of the host's tissue. The æcidiospores produce a germ-tube divided into two parts by a septum, each forming a narrow sterigma. The spermogonia are produced only by mycelium formed by sporidium, are not numerous, and are of the usual form and structure.

Habitat in leaves, stems, and floral parts of *Jasminum grandiflorum*, Linn. N.W. Himalayas.

DESCRIPTION OF THE PLATES.

PLATE XLIX.

Fig. 1. Terminal end of flowering shoot, showing three buds and a node attacked. In teleutosporic stage. Nat. size.

Fig. 2. Upper and lower surface of leaf, with two isolated patches of invasion. In teleutosporic stage. Nat. size.

Fig. 3. A and B. Two views of same stem attacked, showing localized hypertrophy. In teleutosporic stage. Nat. size.

Fig. 4. Æcidiospores. × 350.

Fig. 5. Vacuolated æcidiospore, and isolated peridial cell. × 350.

Fig. 6. Æcidiospore germinated; sterigmatous branches still small. × 350.

Fig. 7. Ditto, with sterigmatous branches fully developed. × 350.

Fig. 8. Teleutospore, showing commencing germination. × 350.

Fig. 9. Teleutospore completely germinated, bearing three sporidia, all of which have emitted germ-tubes while still attached to promycelium. × 350.

Fig. 10. Showing abnormal promycelial development. At (*b*) abnormal formation of sporidium. × 350.

Fig. 11. End of promycelium bearing three sporidia. × 350.

Fig. 12. Promycelium bearing a sporidium which has formed a secondary sporidium while still attached. × 350.

Fig. 13. Leaf showing several points of attack; æcidial stage. Nat. size.

Fig. 14. Showing petiole generally attacked, with much hypertrophy and distortion; mostly in æcidial stage, but showing commencing teleutospore formation. Nat. size.

Fig. 15. Section through the peridium containing teleutospore bed, with elongated stalks (basidia). × 140.

Fig. 16. Section through peridium showing commencing teleutospore formation; æcidiospores on either side. × 140.

Fig. 17. Peridial cells seen flat. × 350.

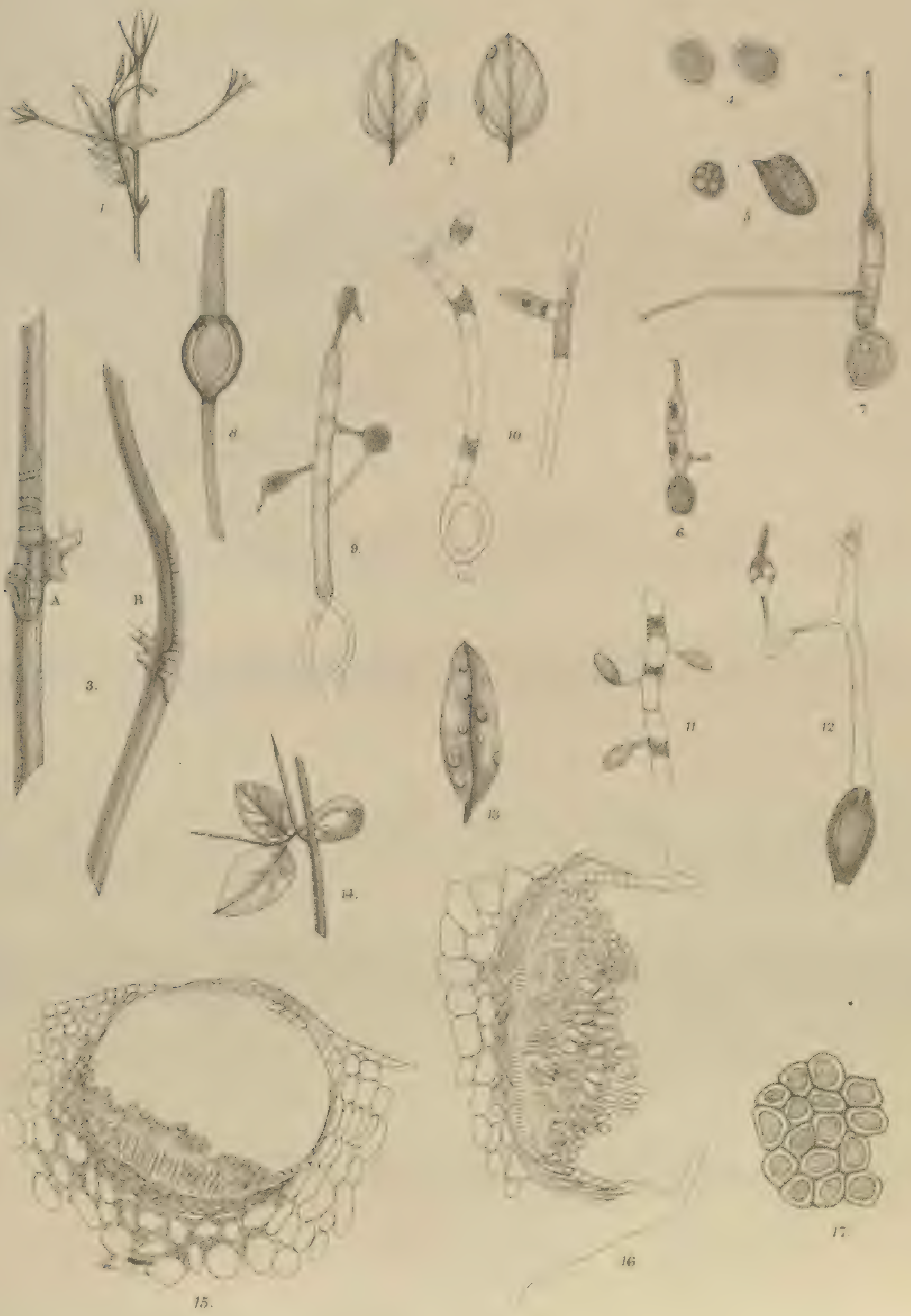
Plate L.

Fig. 1. From photograph showing shoot gathered at Sairi largely attacked in æcidial stage; the result of attack by æcidiospores. Nat. size.

Fig. 2. Portion of section through attacked stem from central pith, showing mycelial invasion. × 350.

Fig. 3. Portion of section through peridium containing teleutospores. × 350.

Fig. 4. Section through peridium in æcidial stage; short layer of basidia as compared with fig. 15. × 140.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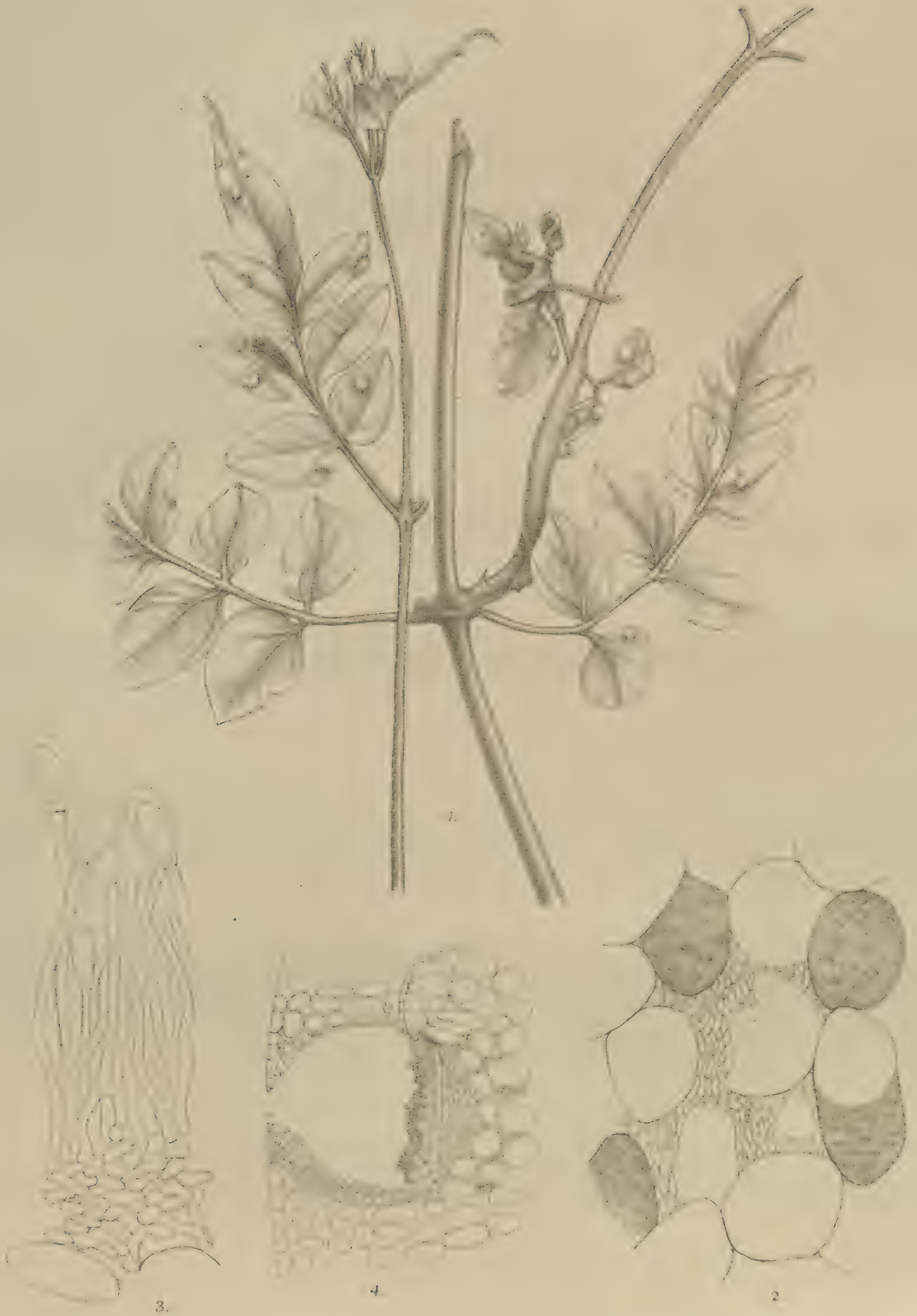
UROMYCES CUNNINGHAMIANUS, *Barclay.*

A. Barclay del.
Berjeau & Highley lith.

West, Newman, imp.



UROMYCES CUNNINGHAMIANUS, Barclay.

A. Barclay del.
[illegible] & [illegible] lith.
West, Newman imp.

LINNEAN SOCIETY OF LONDON.

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Part IV.	1882.	0	7	6	0	5	6
Part V.	1882.	0	3	0	0	2	3
Part VI.	1883.	1	0	0	0	15	0
Part VII.	1883.	0	5	0	0	3	9
Part VIII.	1883.	0	3	0	0	2	3
Part IX.	1883.	0	3	0	0	2	3
Part X.	1884.	0	4	6	0	3	6
Part XI.	1884.	0	10	0	0	7	6
Part XII.	1885.	0	6	0	0	4	6
Part XIII.	1884.	0	6	0	0	4	6
Part XIV.	1885.	0	6	0	0	4	6
Part XV.	1885.	0	4	6	0	3	6
Part XVI.	1885.	0	5	0	0	3	9
Part XVII.	1886.	0	3	0	0	2	3
Part XVIII.	1888.	0	2	6	0	2	0
III. Part I.	1884.	1	14	0	1	5	6
Part II.	1884.	1	12	0	1	4	0
Part III.	1885.	1	10	0	1	2	6
Part IV.	1885.	0	8	0	0	6	0
Part V.	1887.	0	8	0	0	6	0
Part VI.	1888.	0	6	0	0	4	6
IV. Part I.	1886.	1	4	0	0	18	0
Part II.	1887.	1	8	0	1	1	0
Part III.	1888.	0	16	0	0	12	0
V. Part I.	1888.	0	12	0	0	9	0
Part II.	1888.	0	5	0	0	3	9
Part III.	1889.	1	7	0	1	0	0
Part IV.	1890.	0	12	0	0	9	0
Part V.	1890.	0	6	0	0	4	6
Part VI.	1891	0	12	0	0	9	0

Volume.	When Published.	Price to the Public.			Price to Fellows.		
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Part IV.	1876.	0	10	0	0	7	6
Part V.	1878.	1	4	0	0	18	0
Part VI.	1879.	1	6	0	0	19	6
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Part VIII.	1880.	1	1	0	0	16	0
Part IX.	1880.	1	0	0	0	15	0
II. Part I.	1881.	0	12	0	0	9	0
Part II.	1882.	0	5	0	0	3	9
Part III.	1883.	0	10	0	0	7	6
Part IV.	1883.	0	3	0	0	2	3
Part V.	1883.	0	3	0	0	2	3
Part VI.	1884.	0	13	6	0	10	0
Part VII.	1884.	0	9	6	0	7	0
Part VIII.	1884.	0	10	0	0	7	6
Part IX.	1886.	0	7	0	0	5	0
Part X.	1887.	0	3	4	0	2	6
Part XI.	1886.	0	6	0	0	4	6
Part XII.	1886.	0	8	0	0	6	0
Part XIII.	1887.	1	7	0	1	0	0
Part XIV.	1887.	0	7	0	0	5	0
Part XV.	1887.	0	10	0	0	7	6
Part XVI.	1888.	0	2	6	0	2	0
III. Part I.	1888.	3	12	0	2	14	0
Part II.	1891.	0	5	0	0	3	9

2nd Ser. BOTANY.] [VOL. III. PART 3.

THE
TRANSACTIONS
OF
THE LINNEAN SOCIETY OF LONDON.

ON THE SPECIES OF MUSCI AND HEPATICÆ RECORDED FROM JAPAN.

BY

WILLIAM MITTEN, A.L.S.

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June 1891.

III. *An Enumeration of all the Species of Musci and Hepaticæ recorded from Japan.*

By William Mitten, *A.L.S.*

(Plate LI.)

Read 2nd May, 1889.

THE Collections which have furnished materials for the following catalogue are:—(1) That made during the visit of the 'Challenger' Expedition in April and May 1875, the whole of which has one common label as being gathered at Kobe-Kioto and on the Tokiado; (2) Two considerable collections made by James Bisset, Esq., F.L.S., the first in 1879, the second in 1887–1888, in both which the specimens have definite localities; (3) A number of specimens without labels collected by Dr. Maingay; (4) Many other specimens from Mr. Maries and Mr. Dickens, all of which are labelled "Japan."

Thunberg in his 'Flora Japonica,' 1784, gives localities for five Mosses and four Hepaticæ. The collections made by Siebold, which have added so largely to the Flora, are in part described by Dozy and Molkenboer in their 'Musci Frondosi inediti Archipelagi Indici, sive Descriptio et Adumbratio Muscorum Frondosorum in insulis Java, Borneo, Sumatra, Celebes, Amboyna, nec non in Japonia nuper detectorum minusve cognitorum,' 1845–1847, in which were embodied the species described in the 'Annales des Sciences Naturelles,' Paris, 1844 (published separately under the title 'Muscorum Frondosorum Novæ Species ex Archipelago Indico et Japonia,' 1844), and more completely recorded by Van der Sande-Lacoste in the enumeration, including the Hepaticæ, which he contributed to Miquel's "Prolusio Floræ Japonicæ," 1867, in 'Annales Musei Botanici Lugduni Batavorum,' vols. i. & ii. In this are contained those species collected by Oldham and described in the 'Journal of the Linnean Society,' viii. (1864), but those collected by the American Exploring Expedition and described by Sullivant and Lesquereux in the 'Proceedings of the American Academy of Arts and Sciences,' iv. p. 275, 1857–1860, are not mentioned. Lindberg, in his 'Contributio ad Floram Cryptogamam Asiæ Boreali-Orientalis,' 1872 (Acta Soc. Sci. Fenn. x. pp. 221–280), described with his accustomed care five Hepaticæ, of which one was new, and twenty-eight Mosses, of which seven were new and additional to the Flora of Japan, from the collections of Maximowicz. In the 'Mémoires de la Société de Physique et d'Histoire Naturelle de Genève,' tom. xxvi., in his "Choix de Mousses Exotiques nouvelles ou mal connues," Duby described and figured a few Japanese Mosses which he considered to be previously unknown, besides which a few are mentioned by Jaeger and Sauerbeck in 'Genera et Species Muscorum systematice disposita, seu Adumbratio Floræ Muscorum' (1870–1879), by name only, no descriptions of which are known.

Amongst a number of species which are found throughout the temperate regions of the northern hemisphere, the Flora of Japan presents some species which are elsewhere found, in N. India; and a few which belong rather to the eastern side of N. America, without a marked affinity to the species of the Pacific coasts of that continent. The unknown condition of the Bryology of China permits of no comparison being made with that vast and doubtless rich region, nor in the very limited extent of knowledge of the Japanese Moss Flora is it possible to compare the species with those of similar latitudes. The number of species of the genus *Mnium* and also of *Macromitrium* is remarkable; as is also the entirely new aspect given to two genera of Hepaticæ by the occurrence of sacculi in *Mastigophora* and *Blepharozia*, of which the known species had previously given no indication or expectation; and their presence seems to be a foretaste of other strange forms yet awaiting the assiduous collector.

In preparing this enumeration valuable help was kindly given by Mr. C. H. Wright, of Kew, who made many extracts of the descriptions of the species mentioned by Sullivant and Lesquereux, and also by Mr. A. Gepp, of the British Museum, who extracted many portions from Miquel's 'Prolusio' and photographed Duby's figures.

MUSCI.

BRYOZIPHIUM, Mitt. in Journ. Linn. Soc., Bot. xii. 580.

1. B. Savatieri.—*Eustichia Savatieri*, Husnot, Rev. Bryol. v. (1883), p. 85, cum icone.

A small tuft with one capsuliferous stem, '*Challenger*' *Exp.* With old capsules all deoperculate in September, Nikko, *Bisset.*

The capsule of this beautiful Moss is, as suspected by M. Husnot, borne on a seta curved in half a spire. Mr. Bisset's specimens are 4 cm. high, and have the leaves abrupt at their points as figured; in this particular they differ from all the American specimens of *B. norvegicum.* Now that the fruit has been found on both species, and is described as gymnostomous, it is possible to surmise that this genus comes nearer to the Angstrœmiæ than to the Fissidentes; for although the leaves of *Angstrœmia vulcanica*, C. Muell. (*Dicranum filiforme*, Beauv.), are not distichous, a glance at Schwaegrichen's figure, Supp. ii. t. 122, will show how nearly similar in all other respects these Mosses are; there is the same foliage, short and close below, much lengthened out near the perichætium, the same short seta and elongated antheridia. This species, originally gathered in Bourbon, is found also in Jamaica and Peru. *A. Gayana* has its upper leaves shorter and seta longer, and thus connects *A. filiformis* with *A. julacea* and *A. longipes*; all alike have the glossy imbricated foliage as on *Bryum julaceum.*

No species of *Angstrœmia* proper has been described from India; but there is a very small and slender Moss which seems to grow not unfrequently with *Polytricha*:—

A. orientalis, sp. n. Caulis erectus ascendensve simplex, rarius furcatus. Folia bifaria erecta sese amplexantia, arcte imbricata, oblongo-ovalia, apice marginibus incurvis, subacuta sæpius asymmetrica, apicibus subsecundis, interdum squarroso-subsecundis, costa latiuscula pallida sub apice evanescente, marginibus crenulatis subintegerrimisve, cellulis inferioribus subquadratis subrotundisve, superioribus parvis ovalibus inter se remotiusculis, parietibus limpidis firmis. Perichætium apicale foliis plurifariis majoribus oblongis, angustioribus, in acumen patulum canaliculatum productis.

Bhotan, *Griffith*; Sikkim, *Sir J. D. Hooker* and *W. Bell*; Birma, *Kurz.* Caulis 1 cm. altus firmus sæpe plures ex eodem puncto radicali ascendentes, cum foliis vix 0·25 mm. crassus. Folia fusco-olivacea, obscura.

This minute moss has more the appearance of small scattered stems of some species of *Cesia* than of any *Angstrœmia*, and until a few stems were found with apical perichætia it was indeterminable.

DITRICHUM, Timm.

2. D. PALLIDUM.—*Bryum pallidum*, Schreb.

Collected by '*Challenger*' *Exp.*; and at Oyama by *Bisset*; also in China by *Fortune*.

3. D. DIVARICATUM, sp. n. Monoicum. Caulis humilis. Folia a basi oblonga cauli appressa, subito divaricata, subulata, longe angustata, canaliculata, nervo lato supra mediam a pagina indistincto, cellulis brevibus obscuris areolata, apice paucidenticulata; perichætialia æquilonga, dimidio inferiore vaginante, superiore angusto. Theca in pedunculo rubro suberecta, cylindracea, recta.

Shiranesan, with young seta in August; Nantaizan, September, with old capsules, *Bisset*.

Caulis 1 cm. altus. Folia 4 mm. longa, pars erecta 1 mm., pallida, pars divaricata recta, curvata flexuosave, viridis obscura, lævis. Pedunculus 2 cm. altus, satis tenuis, inferne ruber. Theca 3 mm. longa, fere ubique æquilata, angusta, ætate pallida, fere chartacea. Peristomium vetustum, dentibus elongatis.

Quite distinct from *D. pallidum* in the form of its leaves and capsule.

DICRANELLA, Schimp.

4. D. HETEROMALLA, Schimp.—*Dicranum heteromallum*, Hedw.

Nikko, Yumoto, *Bisset*.

TREMATODON, Rich.

5. T. LONGICOLLIS, Rich.

Collected by *Textor*.

DICRANUM, Hedw.

Sect. *Eudicranum*, Mitt. in Journ. Linn. Soc., Bot. xii. 62.

6. D. JAPONICUM, sp. n. Caulis erectus. Folia patula secunda recta falcataque, linealia, sensim angustata, e medio ad apicem argute serrulata, nervo tenui dorso bilineato denticulato, cellulis apicem versus elongatis angustis, inferioribus latioribus, basin versus rectangulatis, parietibus solidis, alaribus fuscis obscuris; perichætialia arcte convoluta, late ovalia, nervo vix conspicuo, in acumen elongatum curvatum lamina angustissima subintegerrima marginatum producta. Theca longe pedunculata cylindracea arcuata, lævis, operculo subulato, peristomio dentibus teneris.

With deoperculate capsules, '*Challenger*' *Exp.*; Oyama and Fujisan, barren, *Bisset*.

Caules 3–4-unciales laxe cæspitantes ut plurimum simplices, inferne radicellis inconspicuis vestiti. Folia 1 cm. longa, flavescentia subnitentia, siccitate, vix mutata. Perichætialia 6–7 mm. longa, acuminibus 2 mm. longis. Pedunculus 4 cm. longus, ruber. Theca 3 mm. longa, fusca, haud plicata, basi subæqualis.

Larger than *D. scoparium*, but without any near resemblance to *D. majus*. The

foliage is sometimes straight and erect, simply patent, or, as so commonly in the allied species, falcate and secund; in all the specimens it is yellow or fulvous.

7. Dicranum scoparium, Hedw.

Chiusenji, with perfect fruit in September; and the variety (*D. Venturii*) with older fruit in May, Fujisan, Yumoto, *Bisset.*

8. D. cæsium, sp. n. Caules laxe cæspitosi erecti simplices furcative, interrupte foliati, radicellis brevibus sparsis vestiti. Folia patula sæpius arcuato-incurva, interdum falcata, apicalia in penicillum erectum appressa, apicibus liberis, omnia inferne anguste elliptica fere a basi sensim angustata canaliculata, nervo crasso concolori dorso ubique minute aspero fere ad apicem angustissimum a pagina distincto, margine crenulato-serrulata, cellulis superioribus parvis ovalibus, basin versus longioribus, dorso minutissime scabris, alaribus paucis pallide fuscis.

Nikko, *Bisset.*

Caulis 4-uncialis. Folia longiora 1 cm. longa, superiora pallide glauco-viridia nitoris destituta, ob nervi crassitudinem satis rigida, sicca, varie flexa, nonnulla circinata.

In its glaucous foliage unlike any of the other Japanese species, and comparable only to the N. American *D. Drummondii,* with which it agrees in the substance of its leaves and scabrous nerve; but in *D. cæsium* the leaves are much narrower, and the nerve in proportion wider and thicker.

9. D. congestum, Brid.

Shiranesan, Yumoto, *Bisset.*

Sect. *Orthocarpa.*

10. D. flagellare, Hedw.

Nantaizan, with fruit not quite mature in September, and Fujisan, *Bisset.*

11. D. hamulosum, sp. n. Dioicum. Caulis simplex furcatusve, inferne tomento subalbido inter folia obtectus. Folia secunda falcata, a basi supra cellulas alares fusciduIas sensim angustata carinata, nervo inferne $\frac{1}{5}$ folii latitudinis occupante ubique a pagina usque ad apicem distincto, dorso minute denticulato-scabro, marginibus supra medium ad apicem serrulatis, cellulis basalibus elongatis, superioribus parvis rotundatis areolata; perichætialia dimidio inferiore vaginantia, subito angustata. Pedunculus gracilis. Theca oblongo-ovalis erecta æqualis striata, operculo subulato æquilongo. Peristomium dentibus breviusculis, annulo simplici.

Barren stems, '*Challenger' Exp., Maries*; and with fruit, Nantaizan, *Bisset.*

Caules 2–4 cm., albi, fusco-rubri. Folia 5–8 mm. longa, sicca, parum mutata, viridia fuscescentia vix nitentia. Pedunculus pallidus, 1 cm. longus. Theca cum operculo 4 mm. longa.

Size and appearance that of *D. Sauteri*; but different in the narrower, more indurated nerve, and in areolation, as well as in the striate capsule; more robust than *D. montanum.*

12. D. striatulum, sp. n. Caulis ascendens simplex furcatusve, tomento pallido parce obtectus. Folia falcata secunda a basi supra cellulas alares pallide fuscas sensim

angustata canaliculata, marginibus interdum convolutis, apicem versus minute serrulatis, nervo inferne $\frac{1}{9}$ folii latitudinis occupante, versus apicem dorso scabro, cellulis ubique elongatis angustis areolata.

Barren stems only, *'Challenger' Exp.*

Caulis 1–2-uncialis. Folia 4 mm. longa, subnitentia, sicca, longitudinaliter striatula.

Very similar to *D. hamulosum*; but with longer and wider leaves, with a different areolation.

Sect. *Chorisodontium.*

13. **DICRANUM CYLINDROTHECIUM**, sp. n. Laxe cæspitosum. Caulis erectus simplex furcatusque, gracilis. Folia erecto-patentia, apicalia subfalcato-secunda angusta, dimidio inferiore elliptico convoluto, superiore sensim angustato, nervo angusto ad summam apicem a pagina angusta argute serrulata distincto, dorso etiam serrulato percursa, cellulis omnibus elongatis angustis alaribus conspicuis magnis quadratis fuscis areolata; perichætialia caulina dimidio longiora late oblonga, convoluta, in acumen breve tenue subintegerrimum erectum producta. Theca in pedunculo brevi cylindracea erecta lævis.

Miogisan, with old fruit in April, *Bisset.*

Caulis 2–3-uncialis infra perichætium innovans continuus, radicellis brevibus inconspicuis vestitus. Folia 6 mm. longa, post exsiccationem fusco-straminea ubique limpida; perichætialia magna pallidiora, 8 mm. longa. Pedunculus 13–14 mm. longus, ruber, tortus. Theca 2 mm. longa, fusca, ore intensiore colorato. Peristomium vetustum, dentibus brevibus teneris.

Much more slender than *D. scoparium.* The seta being short, the capsules are scarcely raised above the terminal leaves of the innovations. The cylindric capsule is different from that of the preceding section, there being no trace of the striation, and it thus agrees with the European *D. Sauteri*, *D. longifolium*, and *D. strictum*, as well as with some S. American species.

Jaeger, Adumb. Musc. ii. 645, mentions a "*Dicranodontium uncinatulum*," *C. Muell.* (in sched.), Japonica, Nikko, trans. Yokohama (*Schaal*).

CAMPYLOPUS, Brid.

14. C. **LEANUS**, Sull.

On rotten wood, barren, *Maries.*

This small species, discovered in America by Lea and published by Sullivant, Musc. Alleg. 172, has been gathered fertile by Griffith at Simla, and probably in the same part of India, barren, by Bell. The equal-sided plicate capsule on a curved seta and the fimbriated calyptra present no differences from the usual states observable among the numerous species allied to the European *C. densus.*

15. C. **BLUMII**, Van den Bosch et Lacoste, Bry. Javan. t. 68.

Recorded in Miquel's Prolusio (Ann. Mus. Bot. Lugd. Bat. ii. 292) from several collections.

ONCOPHORUS, Brid.

Sect. *Rhabdoweisia*, Schimp.

16. O. STRIATUS.—*Grimmia striata*, Web. & Mohr.

A few scattered plants amongst *Lepidozia setacea*, ‘*Challenger*’ *Exp.*

Sect. *Euoncophorus.*

17. O. CRISPIFOLIUS.—*Didymodon crispifolius*, Mitt. in Journ. Linn. Soc., Bot. viii. p. 148.

Intermixed with Mosses, barren, ‘*Challenger*’ *Exp.*

Mii, Sagami-gawa, June, *Bisset.*

18. O. WAHLENBERGII, Brid.

Fujisan, with fruit, *Bisset.*

CERATODON, Brid.

19. C. PURPUREUS, Brid.

Dr. Maingay.

GRIMMIA, Ehrh. Beitr. i. 176.

Sect. *Schistidium.*

20. G. APOCARPA, Hedw.

A few stems amongst *Glyphomitrium Wilsoni*, ‘*Challenger*’ *Exp.*; Nikko and elsewhere amongst mosses, *Bisset.*

Sect. *Rhacomitrium*, Brid.

21. G. FASCICULARIS, C. Muell.

Hakoni Pass, Nantaizan, Umagayeshi to Chiusenji, with young fruit in September, *Bisset.*

Most of the specimens have a different look from the usual states of this species, from the leaves being a little longer and more channelled, but they are mixed with others not appreciably differing from European.

22. G. CANESCENS.—*Trichostomum canescens*, Timm.

Fujisan, with complete fruit, *Bisset.*

23. G. LANUGINOSA, C. Muell.

Fujisan, fertile, *Bisset.*

24. G. HETEROSTICHA, C. Muell.

Nantaizan, barren, *Bisset.*

25. G. JAPONICA, Dozy et Molk. Musc. Frond. Archip. Ind. et Jap. 130, t. 41.

Gathered by Siebold: seems to be *G. canescens*; but Sande-Lacoste in Miquel, Ann. Mus. Bot. Lugd. Bat. iv. p. 181, compares it to *G. sudetica.*

GLYPHOMITRUM, Brid.

26. G. Wilsoni.—*Ptychomitrium Wilsoni*, Sull. et Lesq.

In small quantity with empty capsules, '*Challenger*' *Exp.*; Nagasaki, *Oldham*; Joshin and Senkokuhava, *Bisset.*

27. G. sinense, Mitt. in Journ. Linn. Soc., Bot. viii. 149; and
28. G. dentatum, *ejusd.* l. c.

Both gathered by *Oldham*, are also found in China.

Henoniella, gen. nov., *H. japonica*, Duby, in Mém. Soc. Phys. Hist. Nat. Genève, xxvi. (1879) 3, if considered from the figure which he gives, might be supposed to be *Glyphomitrium Wilsoni*; but in his description he repeatedly says it is julaceous and extremely elegant, comparing it to *Pilopogon*; it was collected by *Dr. Henon* at Ikouao.

OCHROBRYUM, Mitt. in Journ. Linn. Soc., Bot. xii. 107.

29. O. Gardnerianum.—*Leucophanes Gardnerianum*, C. Müll. Syn. i. 85.

A few fragments, '*Challenger*' *Exp.*; also barren by *Bisset.*

A very doubtful moss until its fructified state has been found, and, like some Indian specimens, placed in this genus in default of any distinction having been discovered. It is mentioned by Lindberg, and is probably the barren *Leucobryum glaucum* mentioned in Miquel's 'Prolusio' (in Ann. Mus. Bot. Lugd. Bat. ii. 292) as gathered by *Textor*.

OCTOBLEPHARUM, Hedw.

30. O. albidum, Hedw.

A few small specimens gathered by *Maingay*.

LEUCOBRYUM, Hampe.

31. L. scabrum, Van der Sande-Lacoste in Miquel's Ann. Mus. Bot. Lugd. Bat. ii. 292.

Gathered by *Siebold*; is found also in Hong Kong.

It is not quite so robust as *L. javense*, and, like it, will probably prove to be a *Pegophyllum*.

WEISIA, Hedw.

32. W. controversa, Hedw.

A small specimen with old fruit, '*Challenger*' *Exp.*; in the same condition at Yokohama and Miogisan, *Bisset*; also by *Siebold* and *Textor*.

SYSTEGIUM, Schimp.

33. S. crispum, Schimp.

Gathered by *Textor*.

TORTULA, Hedw.

Sect. *Hyophila.*

34. T. SPATHULATA.—*Gymnostomum spathulatum*, Harv.

A small barren tuft, '*Challenger*' *Exp.*

Sect. *Desmatodon.*

35. T. EMARGINATA, Dozy et Molk. Musc. Frond. Archip. Ind. et Japon. 50, t. 20. (Barbula.)

Collected by *Siebold.*

Sect. *Helicopogon.*

36. T. UNGUICULATA, Roth.

By *Siebold* and *Textor.*

37. T. INFLEXA.—*Trichostomum inflexum*, Bruch.

Mentioned in Miquel.

POTTIA, Ehrh.

38. P. LANCEOLATA, C. Muell. var. (=*Gymnostomum intermedium*, Turn.).

Collected by *Textor.*

ANŒCTANGIUM, Hedw. Sp. Musc. i. 40.

39. A. PULVINATUM, sp. n. Planta fœminea: pulvinatim cæspitosum, inferne radicellis fuscis laxe contextum. Folia humida patentia, sicca laxe contorta incurvaque a basi erectiore, cellulis rotundis paucissimis ad nervi latera elongatis, subovata, pellucida, inde angustata lineali-lanceolata acuta, nervo concolore percursa carinata, apice pellucida, cellulis obscuriusculis areolata.

Nikko, *Bisset.*

Caules uncia major, cum foliis humidis 2 mm. lati. Folia inferiora fusca, superiora viridia, 1 mm. longa.

40. A. TORQUESCENS, sp. n. Planta mascula: humilis. Folia humida patentia, sicca appressa contorta oblongo-linealia, ubique fere æquilata, acuta, e cellulis densis obscuris areolata.

A very small tuft, '*Challenger*' *Exp.*

Caulis centimetro minor. Folia 1 mm. longa, fusco-viridia.

This differs from the preceding in the form and areolation of its leaves, almost the only distinctions available in the genus. In both the inflorescence is found in the usual position and it is almost exactly uniform in all.

DRUMMONDIA, Hook.

41. D. CLAVELLATA, Hook.

With capsules some time past maturity and empty, '*Challenger*' *Exp.*

The specimens agree with American, but are a little more robust.

AULACOMITRIUM, gen. nov.

Theca apicalis, æqualis. Folia perichætii in vaginam exsertam convoluta. Calyptra mitriformis, plicata.

42. A HUMILLIMUM, sp. n. (Plate LI. figs. 1–5.) Cæspitosum. Caulis simplex erectus. Folia patentia sicca appressa lanceolata linealiaque, apice subacuminata integerrima, nervo angusto in mucronem pungentem excurrente carinata, marginibus late recurvis, e cellulis rotundatis parvis obscuratis, basi ad nervum paucis oblongis areolata; perichætialia duplo longiora late convoluta obtusa. Theca breviter exserta brevis ovalis, operculo conico rostrato, demum evacua subplicata turbinata, peristomio dentibus 16 per paria approximatis, siccitate revolutis, teneris, fuscis. Calyptra thecam totam obtegens, pluries plicata, basi multifissa.

Gathered by *Maingay*. The specimens are all embedded in earthy matter. The *Macromitrium calycinum* gathered in imperfect state by Textor and enumerated by Van der Sande-Lacoste probably belongs to this; it is without locality.

Caules 3 mm. alti, laxe pulvinatim aggregati. Folia 1–1½ mm. longa, olivacea fuscescentia. Perichætium fere 2 mm. longum, setam fere totam involvens. Theca 0·50 mm. longa, collo nullo, a membrana tenera cellulis homomorphis condita. Calyptra 1 mm. longa.

The habit and foliage of this small Moss is similar to that of those species of *Zygodon* which generally agree with *Z. viridissimus*; but the capsule, which at length becomes turbinate, with its small membranous teeth, and the plicate mitriform calyptra remove it from that genus. The vaginate perichætium is a character found neither in *Orthotrichum* nor in *Macromitrium.*

A. CALYCINUM, Mitt. (*Macromitrium calycinum*, Mitt. in Journ. Linn. Soc., Bot. iii. Supp. 49) is another species of this genus; its capsule is smooth, longer and narrower, and its peristome, so far as can be seen, has equidistant teeth; its calyptra, seen only in a young state, is finely striate. Of the male inflorescence nothing is known, and the state of the specimens is insufficient to show whether the fertile stems are independent in their origin, or, as was supposed in the Ceylon specimens gathered by Gardner and again by Thwaites, they arise from a creeping primordial stem; these appear to have grown on trees, but in the Japanese species appearances are against their habitat being arboreal.

ULOTA, Brid.

43. U. REPTANS, sp. n. Monoica. Caulis procumbens repens, ramis brevibus assurgentibus. Folia patentia sicca appressa, a basi orbiculari excavata cellulis, paucis ad

nervum oblongis, sensim angustata, nervo percurrente carinata, marginibus recurvis, cellulis rotundis parvis limitibus latis pellucidioribus areolata; perichætialia conformia. Theca ovalis plicata collo sensim angustato, peristomio dentibus 8, ciliis? Calyptra ramentis appressis, ea brevioribus pilosa.

Fujisan, on branches, May, *Bisset.*

Caulis repens, 3 cm. longus, ramis 1 cm. longis. Folia 1·50 mm. longa, viridia nigrescentia, haud crispata. Theca cum collo 4 mm. longa, sporangio 1 mm. longo.

A small species which seems very distinct in its creeping stems.

44. ULOTA AMERICANA, Mitt. in Journ. Linn. Soc., Bot. viii. 26.

Kintoki, *Bisset.*

Appears to be quite the same as American specimens.

45. U. JAPONICA (*Orthotrichum japonicum*, Sull. et Lesq.) was collected on trees in shaded ravines, Hakodadi. Sullivant, with the specimens of both before him, suggests that this and *U. Barclayi*, Mitt. (v. Sull. Icones, Supp. 56), may be forms of one species.

ORTHOTRICHUM, Hedw.

46. O. ROGERI, Brid. Collected by *Siebold* (Van der Sande-Lacoste, Miquel, Ann. Mus. Bot. Lugd. Bat. p. 293).

Fragments indicate the presence of other species.

MACROMITRIUM, Brid.

Sect. *Goniostoma*, Mitt.

47. M. JAPONICUM, Dozy et Molk. in Ann. Sc. Nat. 1844, 311.—*M. spathulare*, Mitt. in Journ. Linn. Soc., Bot. iii. Supp. 50.

With mature fruit, '*Challenger*' *Exp.*; also by *Maingay.*

48. M. RUPESTRE, Mitt. in Journ. Linn. Soc., Bot. viii. 150.

With old fruit, '*Challenger*' *Exp.*

This forms extensive patches of short upright branches; young foliage yellowish green, the older brown.

49. M. INSULARUM, Sull. et Lesq.

Simoda, *Amer. Expl. Exp.*

From description it belongs to this group; it is said to have the habit of *M. rupestre*, but acute leaves and very pilose calyptra.

50. M. PROLONGATUM, sp. n. Caules procumbentes, inordinate ramosi ramis prolongatis. Folia elongata, lineali-lanceolata, apice acutissima, humida a basi erectiore patentia, sicca cauli appressa, in apicibus ramorum ramulorumque longiora, apice latiora, siccitate flexuoso-curvata, omnia nervo percursa, e cellulis basin versus paucis oblongis, superioribus rotundatis areolata; perichætialia erecto-patentia elongate lanceolata,

sensim angustata, usque ad basin thecæ ovalis lævis producta. Peristomium e dentibus teneris brevibus. Calyptra ramentis densissime vestita.

Kintoki, *Bisset.*

Cæspites laxi. Rami appressifoliati 3–5 cm. longi, ramulis sæpe brevissimis, statu humido stellatim foliatis. Folia longiora 2 mm. longa longiorave. Theca 2 mm. longa, in pedunculo æquilongo, cinnamomea, ore carnosula intensiore colorata.

The habit of this species is quite different from that of the preceding; instead of the stems being creeping with aggregated erect branches, they seem merely procumbent and thus form a loose tuft.

51. Macromitrium gymnostomum, Sull. et Lesq.

Kintoki, Hakone, *Bisset.*

In this species the short branches are aggregated into extensive patches. The calyptra, although that of the genus, is split more on one side, and, with some other species in which the calyptra is found in the same condition, has been enumerated by Lindberg, *l. c.* p. 229, as belonging to *Dasymitrium*, *M. rupestre* and *M. incurvum* being also included.

52. M. incurvum.—*Dasymitrium incurvum*, Lindb. in Seem. Journ. of Bot. 1864, p. 385 (*M. japonicum*, C. Muell. Syn. i. 740).

C. Mueller received specimens of this mixed with *M. japonicum*, and thus described the wrong species (Miquel, in Ann. Mus. Bot. Lugd. Bat. ii. 294; Prolusio, 182).

53. M. comatum, sp. n. Humilis, laxe cæspitosus. Caulis fertilis ramosus, foliis patentibus diversimodo curvatis, a basi parum latiore lineali-elongatis, apice latis, obtuse acutis, sæpe incurvis, margine papillis prominulis minute erosis, nervo flavo carinatis, cellulis superioribus obscuris, inferioribus pellucidioribus, infimis paucis ad nervum oblongis areolatis; perichætialibus brevioribus lanceolatis erectis. Theca in pedunculo brevi, basi ramentis elongatis exsertis, oblonga, operculo conico brevirostro. Calyptra magna, thecam totam obtegens, ramentis, fulvis erectis elongatis copiosis vestita.

Umagayeshi to Chiusenji, in loose tufts with *Lasia fruticella* and *Anomodon tristis*; fruit immature in September, *Bisset.*

Rami fertiles 1–2 cm. alti, cum foliis humidis 3 mm. lati. Folia 3 mm. longa, inferiora fusca fulvave, superiora viridia, sicca laxe crispata. Pedunculus 2–3 mm. longus, angulatus, flavidus. Theca cum operculo 2 mm. longa, plicata (?), immatura. Calyptra a basi ad apices ramentorum 4 mm. longa.

In its short seta and very ramentose calyptra this resembles *M. prolongatum*; but its stems are shorter and not so diffused, its leaves are not so narrowed towards their more obtuse points, and they are more obscured with papillæ; the perichætial leaves are very different, much shorter than those of the stem, so as to be inconspicuous, whereas in *M. prolongatum* the perichætial leaves reach to the neck of the capsule and are as long as those of the stems.

The fruit is too immature to show the carnose mouth so characteristic of this section, but in all other respects it corresponds.

TETRAPLODON, Bruch et Schimp.

54. T. MNIOIDES, Bruch et Schimp.
Nantaizan, *Bisset.*

55. T. ANGUSTATUS, Bruch et Schimp.
Nantaizan, growing in the same tuft with the preceding, both perfectly fruited, *Bisset.*

PHYSCOMITRIUM, Brid.

56. P. JAPONICUM.—*Gymnostomum japonicum,* Hedw.
Oyama, *Bisset*; gathered also by *Maingay.*

FUNARIA, Schreb.

57. F. HYGROMETRICA, Hedw.
Chiusenji, *Bisset.*

BARTRAMIA, Hedw.

58. B. POMIFORMIS, Hedw. var. CRISPA.—*B. Henoni,* Duby, in Mém. Soc. Phys. Hist. Nat. Genève, xxvi. t. ii. 2. f. 2.

With fruit just mature, '*Challenger*' *Exp.*; also by *Prof. Thomson*; and at Fujisan, Joshin, Nantaizan, and Mii Sagamigawa, *Bisset.* All the specimens very luxuriant. It is mentioned by Lindberg and by Sande-Lacoste.

PHILONOTIS, Brid.

59. P. SOCIA, Mitt. in Journ. Linn. Soc., Bot. viii. 151.
Small specimens, '*Challenger*' *Exp.*

60. P. LANCIFOLIA, Mitt. in Journ. Linn. Soc., Bot. viii. 151.
Nagasaki, *Oldham.*

61. P. FONTANA is mentioned by Lindberg from some imperfect specimens.

62. P. CARINATA, sp. n. Caules in cæspitem densum, inferne radicellis intertextum, congesti. Folia humida patentia, laxe imbricata, carinato-concava, ovata, obtusiuscule acuta, nervo sub summo apice desinente, margine minute serrulata, cellulis oblongis ovalibusve laxis subpellucidis areolata, sicca appressa incurva, apicalia in cuspidem acutam imbricata. Theca in pedunculo elongato globosa inæqualis inclinata, operculo depresse conico.

Kiga Miyanoschi, with capsules imperfectly ripened, *Bisset.*

Caulis uncialis, gracilis, cum foliis 1 mm. angustior. Folia juniora viridia obscura, humida subflaccida. Pedunculus uncialis, ruber. Folia perichætialia parva acuta.

Very different from the preceding species in its wide soft leaves. The fructification is in bad state for examination.

BRACHYMENIUM, Hook.

63. B. CLAVULUM, sp. n. Monoicum. Caulis humilis ramosus, pulvinatim cæspitosus, inferne radicellis rubiginosis intertextus. Folia in rosulis terminalibus disposita, humida patentia, sicca contorta obovato-lanceolata ovali-lanceolatave, nervo sub apice desinente vel in acumen capillare integerrimum producto, limbo angusto e singula serie cellularum formato apicem versus subserrulato marginata, cellulis ovali-hexagonis areolata. Theca oblongo-ovalis erecta sensim in pedunculum angustata, operculo conico apice abrupto, peristomio dentibus divergentibus, interno membrana brevissima annulari.

Ikao, with rather old capsules, August, *Bisset*.

Caulis cum ramis 6–7 mm. altus, innovationibus pluribus fastigiatis ramosus. Folia cum apiculo piliforme vix 2 mm. longa. Pedunculus 15 mm. longus, rectus flexuosusve. Theca cum operculo 3 mm. longa, fusca.

Very similar to *B. brevicaule* in appearance, but differing in the form of its leaves —less wide towards the apex—and the longer more claviform capsule. The foliage of this species is very similar to that of *Bryum capillare*, and the nerve vanishes just below the apiculus or is continued and excurrent as in that species.

WEBERA, Hedw.

64. W. ELONGATA, Schwaegr.
Nantaizan, *Bisset*.

65. W. LONGICOLLIS, Hedw.
In the same locality, *Bisset*.

66. W. NUTANS, Hedw.
Mitake, alt. 5000–6000 ft., *Bisset*.

BRYUM, Dill.

Sect. *Dicranobryum*, C. Mueller.

67. B. SCABRIDENS, Mitt. in Journ. Linn. Soc., Bot. viii. 151.—*Webera brevicolla*, Sande-Lacoste in Miquel, Ann. Mus. Bot. Lugd. Bat. ii. 294.
'*Challenger*' *Exp.*; also by *Maingay*; and at Nagasaki, *Oldham*.

68. B. CELLULARE, Hook., Schwaegr. Sup. iii. t. 214^{8}.—*B. megalodictyon*, Sull. et Lesq. ?
Joshin, *Bisset*.

Sect. *Eccremothecium*.

69. B. CAPILLARE, Linn.
Oyama, *Bisset*; Nagasaki, *Oldham*.

This is first mentioned in Miquel as *B. torquescens*; but in the Ann. Mus. Bot. Lugd. Batav. iv. 308 it is corrected to *B. capillare*.

70. B. ARGENTEUM, Linn.
Enumerated by Thunberg and Sande-Lacoste.

71. **Bryum roseum**, Schreb. Japanese name "Kasa-goke."

Kintoki, *Bisset*; also gathered by *Dickens, Ito Keiske*, and *Siebold*; all barren.

It is recorded by Dozy and Molkenboer, and also mentioned by Sande-Lacoste as *B. giganteum*, Hook.

MNIUM, Dill.

Sect. *Eumnium*.

72. **M. trichomanes**, Mitt.—*M. acutum*, Lindb. in Act. Soc. Sci. Fenn. x. (1872) p. 227.

With capsules just matured, '*Challenger*' *Exp.*; Ikegami, Nikko, and elsewhere, *Bisset*.

This appears to be a common species, so frequently growing with other terrestrial Mosses; and is probably the *M. cuspidatum*, mentioned by Dozy and Molkenboer and in Ann. Mus. Bot. Lugd. Bat. ii. 294, to which it has a close resemblance in size and colour.

73. **M. rostratum**, Schwaegr.

Nagasaki, *Oldham*; Kurosawa, *Bisset*.

74. **M. spathulatum**, sp. n. Dioicum. Folia laxe disposita, patula, oblongo-ovalia, suprema oblongo-spathulata, omnia obtusa, nervo in mucronem minutum excurrente, margine limbo e seriebus tribus cellularum composito simpliciter serrulato, cellulis parvis rotundatis areolata. Theca in pedunculo elongato rubro ovato-ovalis, pallida, nutans, operculo conico brevirostro.

Small specimen of the female plant in poor state, sterile, '*Challenger*' *Exp.*; perfectly fruited specimens in May at Kurosawa, Shinano, *Bisset*; Nagasaki, *Oldham*; Tsus Sima, China, *Wilford*.

Habitus, statura, faciesque omnino *M. rostrati*; foliis autem e cellulis minoribus areolatis, floribusque diversis. Flores masculi in capitulis cyathiformibus acervati.

There is a slight difference observable in the form of the capsule; it is slightly ovate-oblong, and not regularly oval.

75. **M. speciosum**, sp. n. (Plate LI. figs. 6–9.) Caulis fertilis elatus simplex, inferne radicellis fuscis, foliis late oblongis obtusis retusisve. Folia superiora comalia longiora oblongo-lanceolata, patentia, nitida, nervo basi lato sensim angustato, ramulis pluribus in paginam dissolutis, apice in mucronem acutum excurrente, marginibus flexuosis limbo quadriseriato, ciliis pluribus æquidistantibus e cellula unica angustissima acuta formatis divergentibus ex apice usque ad basin angularum foliorum longe in caulem decurrentium fimbriata, cellulis transverse anguste oblongis, a nervo ad limbum marginalem in lineas sursum curvatas dispositis, parietibus angustis concoloribus areolata. Thecæ plures ex eodem perichætio oblongæ, brevicolles, nutantes. Peristomium e dentibus processibusque castaneis.

Yumoto, with fruit past maturity in August, *Bisset*.

Caulis fertilis 3–4-uncialis, inferne subnudus. Folia inferiora brevia sensim versus comam longiora, comalia centimetrum longa, 5 mm. lata, omnia pallide stramineo-viridia,

nitida, chartacea, marginibus siccitate undulatis, limbo tenui concolore indistincto pulcherrime ciliato.

This fine Moss differs from all known species of the genus in its stiff, thin, shining foliage, which does not curl up in drying and has thus no near resemblance to *M. undulatum.*

The nerve, with its numerous lateral branches vanishing in the substance of the leaf, is a singularly remarkable character, but the arrangement of the cells in curved lines ascending from the nerve obliquely to the margin is to be seen also in *M. cinclidioides.* Barren stems are present among the fertile and appear to grow erect, the apices with leaves decreasing in size.

76. MNIUM ACULEATUM, sp. n. (Plate LI. figs. 10–13.) Dioicum. Caulis fertilis gracilis simplex, inferne radicellis nigrescentibus obtectus. Folia inferiora et in caulibus sterilibus ovalia late obovataque, in acumen breve angustata, marginibus breviter paucidentatis, comalia patentia majora obovato-oblonga longius acuminata, nervo sub apice desinente, marginibus inferioribus recurvatis, inde ad apicem acutum usque serraturis acutis aculeiformibus simplicibus, limbo e seriebus tribus cellularum condito cartilagineo, apice in mucronem pungentem confluente, cellulis parvis 5–6-gonis marginem versus minoribus areolata. Theca ovalis nutans, evacuata sub ore constricta, basi collo brevi, flexura angusta in pedunculum transiens.

Chiusenji, Aug., *Bisset.*

Caulis fertilis unciâ brevior. Folia inferiora 2 mm., comalia 4 mm. longa, ubi latiora 1 mm. vix excedentes, sicca parum crispata, dentibus marginalibus e tribus cellulis compositis, spatiis intermediis subsinuatis. Pedunculus 4 cm. longus. Peristomium dentibus ceraceis, internum fuscum.

77. M. UNDULATUM, Hedw.

Recorded by Dozy and Molkenboer (Musc. Frond. Archip. Ind. p. 28), by Van der Sande-Lacoste, and by Lindberg, in a sterile state only, from Sennano, ins. Nippon.

78. M. MAXIMOVICZII, Lindb. in Act. Soc. Sci. Fenn. x. (1872) p. 224.

A smaller species with linguiform oblong leaves, emarginate at the apex, with from one to six setæ arising from the same perichætium; it is fully described and compared to *M. undulatum.* It was gathered at Yokohama; also

79. M. JAPONICUM, Lindb. *l. c.* 226.

With rhombo-obovate long acuminate leaves, having the margins recurved from the base to the middle and thence to the apex fimbriato-ciliate; it is compared to *M. medium,* and came from Fudzi, ins. Nippon, gathered by Maximowicz. The description agrees with the leaves of *M. aculeatum,* which appears to be very much smaller.

Sect. *Rhizomnion.*

80. M. STRIATULUM, sp. n. Dioicum. Folia comalia obovata ovaliaque, basi angustata, apice apiculo parvo obtuso rotundata, e cellulis parvis areolata. Theca in pedun-

culo gracili elongato pendula oblonga, operculo convexo breviter curvirostrato, peristomio dentibus ceraceis.

With fruit not quite mature in February, *Maries*; also by *Bisset.*

Resembling *M. punctatum*, but differing in the smaller size of its leaves, which are composed of much smaller cells, in the longer and more slender setæ, and possibly in its empty capsules being sixteen-plicate, a condition observable in the few available for examination. With this agree several small specimens collected in N.W. America by Douglas and Lyall; the denser areolation is the same, but the American specimens have the limb and nerve broader and thicker.

81. MNIUM RETICULATUM, sp. n. Dioicum. Folia majora orbiculari-obovata, basi angusta, margine limbata integerrima, nervo infra apicem rotundatum evanescente, cellulis ubique majusculis hexagono-rotundis areolata. Theca in pedunculo elongato rubro ovalis, inclinata nutansve. Peristomium dentibus ceraceis, internum fuscum

Ubago, Hakone, with old fruit in May, *Bisset.* To this the *M. punctatum* gathered in Sikkim by Sir J. D. Hooker appears to belong.

Habit, size, and colour of *M. punctatum*; but the leaves have cells everywhere double in diameter those of European *M. punctatum.* The stems are more branched than is usual in the European species, and the capsules are rather smaller. *M. punctatum*, var. *β. elatum*, mentioned by Miquel, in Ann. Mus. Bot. Lugd. Bat. ii. 294, may belong here.

All the species referable to this section grow in the same manner from a stratum of brown interwoven radicles, and have a close resemblance to each other in habit and foliage. The bisexual inflorescence sufficed to distinguish *M. subglobosum.* There is also a curious Indian species—*M. parvulum*, Monoicum. Folia comalia spathulato-obovata, apice acuta, apiculo brevissimo. Flores masculi in apicibus ramulorum, infra perichætium egredientibus parvifoliis.

Simla, on dead trees at Fagoo, *Griffith*, 143.

Stratum radiculorum rubiginosum latissime extensum panniforme. Caules 3–4 mm. alti. Folia majora circiter 2 mm. longa. Pedunculus 1 cm. altus, gracillimus. Flos masculus fere gemmiformis, facillime inter folia comalia prætervisus.

Griffith's specimens are very old, and the capsules are mostly spoiled by insects. The fertile stems are so short and small that they are almost covered by the thick mass of rootlets. The inflorescence in some stems, when not fully grown out, shows the male flowers in a small closed bud; in others, the leaves surrounding the antheridia, although small, are of the usual form.

This small species, if indeed it is always so small and short-stemmed as in the only specimens as yet known, is distinguishable by its inflorescence; but the distinctions in the two Japanese species are not so readily made out. *M. reticulatum* has larger cells, *M. striatulum* smaller than in *M. punctatum.* Lindberg says (*l. c.* p. 228) that his specimen from Faxoni, Nippon, agreed exactly with European *M. punctatum*, but that others from Japan did not; and mentions some from Sitka, which are no doubt the same species with the British N.W. American, and these latter are remarkable for the thick limb; the few capsules seen do not afford any character, being almost exactly alike in all the species.

Sect. *Polla*, Brid.

82. Mnium orthorhynchum, Brid.

With old fruit, '*Challenger*' *Exp.*; Fujisan, Senkokuhava, *Bisset.*

Fragments seem to indicate another species with wider leaves.

Sect. *Trachycystis*, Lindb.

83. M. radiatum, Wils. in Hook. Lond. Journ. Bot. vii. (1848) p. 274, t. 10.—*M. microphyllum*, Dozy et Molk. Musc. Frond. Archip. Ind. et Jap. 27, t. xii.

Specimens well fruited, but past maturity, '*Challenger*' *Exp.* It appears to be common and gathered by all collectors.

84. M. flagellare, Sull. et Lesq. in Proc. Amer. Acad. (1859) p. 277.

Fujisan, *Bisset.*

Small terete shoots arise near the perichætium, similar to those in some dicranoid Mosses, as *D. flagellare* and some species of *Holomitrium.* Lindberg says (*l. c.* p. 241) that this is found also in Amuria.

HYPOPTERYGIUM, Brid.

85. H. japonicum, Mitt. in Journ. Linn. Soc., Bot. viii. 155; Van der Sande-Lacoste in Miquel, Ann. Mus. Bot. Lugd. Bat. ii. 296.

Nagasaki, *Oldham, Bisset.*

In Miquel, *l. c.*, it is stated that antheridia were not observed in the flowers examined; a fresh search having been made, it is found that they are absent or present in the female flowers on the same stem. A much smaller and more tender species is

H. sinicum, sp. n. Dioicum? Humile, gracile, subflaccidum. Stipes brevis in frondem triangularem divisus. Folia patenti-divergentia late ovata, mucrone brevi, nervo debili angusto vix ultra medium producto, margine limbo angusto, apice pauciserrato, subintegerrima, e cellulis parvis ovali-hexagonis limitibus angustis areolata. Folia stipuliformia dimidio minora rotundo-ovata.

Hong Kong, *Sir J. C. Bowring.*

Stipes 3–5 mm. altus, subnudus. Rami cum foliis expansis 2 mm. lati. Folia pallide æruginosa.

RHACOPILUM, Brid.

86. R. aristatum, Mitt. in Journ. Linn. Soc., Bot. viii. 155.

Yokohama, *Oldham.*

RHIZOGONIUM, Brid.

Sect. *Pyrrhobryum.*

87. R. Dozyanum, Van der Sande-Lacoste in Miquel, Ann. Mus. Bot. Lugd. Bat. ii. 295.

A few barren stems, '*Challenger*' *Exp.* In perfect fruit in October, Hakone Pass, *Bisset.*

This fine species, so well figured in the place cited, is, in a fresh state, of a glaucous green: it was described from Siebold's specimens as rufous, which it probably becomes in age, like its nearest species, *Rhizogonium spiniforme*.

ERPODIUM, Brid.

88. E. JAPONICUM, Mitt. in Journ. Linn. Soc., Bot. xxii. 314. (Plate LI. figs. 14–20.)

On bark, '*Challenger*' *Exp.*

This minute Moss agrees entirely in habit and colour with *E. domingense*, *E. ceylanicum*, and *E. Hanningtoni*. All have the fertile branches with larger leaves. Until the discovery of this species, the genus had been supposed to be gymnostomous. The typical species being *E. domingense*, in which the capsule is exserted, from this the *Aulacopilum* of Wilson differs only in its calyptra clasping at base, and opening laterally as in *Calymperes*. Considerably different from these species is the *Leptocalpe* (*E. coronatum*) of the "Musc. Aust.-Amer.," in Journ. Linn. Soc., Bot. xii. 403, which C. Mueller thinks to be the same as Montagne's *Leptangium*, the calyptra of which last is undescribed. In *E. coronatum*, as in *E. japonicum*, the capsule is immersed. In the last it is of thin paper-like substance, pale green in colour except at the mouth, which has a band of orange-coloured cells corresponding with the teeth, which are regular in outline, smooth and wax-like in substance.

DENDROPOGON, Schimp.

89. D. DENTATUS, sp. n. Caulis primarius repens. Rami decumbentes, demum penduli, ramulis inordinatis pinnati. Folia ramea patentia subdivergentia, sicca appresse imbricata, a basi ovata inferne marginibus recurvis caulem amplexante in acumen lanceolatum planum producta, nervo infra apicem remote dentatum evanido, cellulis superioribus oblongis basalibus ad angulos transverse oblongis. Folia ramulina angustiora fere ovato-lanceolata, siccitate magis appressa.

A small specimen, with branches from two to four inches long, '*Challenger*' *Exp.* With branches as much as nine inches long, Nikko, *Dr. Woods*, *Bisset*.

Rami cum foliis expansis 2 mm. lati, ramulis ut plurimis semiuncialibus, rarius subuncialibus, divergentibus. Folia fusco-viridia, obscura.

Very much like the Indian *D. ferrugineum* from the Nilgiri Mountains; but a little more slender, and with leaves a little shorter. Fruit has yet to be discovered for both species to be certainly placed in this genus; they are, however, unlike any species of *Meteorium*.

HEDWIGIA, Ehrh.

90. H. CILIATA, Ehrh.

Small specimen, '*Challenger*' *Exp.*; also gathered by *Bisset*.

LEUCODON, Schwaegr.

91. L. SECUNDUS, Mitt. in Journ. Linn. Soc. iii. Suppl. 124.

Nantaizan, Nikko, *Bisset*.

The specimens have exactly the appearance of those found in India.

CLIMACIUM, Web. et Mohr.

92. C. JAPONICUM, Lindb. in Act. Soc. Sci. Fenn. x. (1872) p. 232.—*Pterobryum imbricatum*, Duby, in Mém. Soc. Phys. Hist. Nat. Genève, xxvi. p. 6, tab. 1. f. 1.

A single barren stem, '*Challenger*' *Exp.*; Hakone and Umagayeshi, with two fertile stems in September, *Bisset*; gathered also by *Maries*.

Duby's figure, although not completely filled in by the artist, gives a fair idea of the appearance of moderately well-grown stems, and in this state Mr. Bisset's were fertile. Mr. Maries's specimens are larger and more branched, but barren. *C. americanum*, Brid., is enumerated by Van der Sande-Lacoste as found abundantly in fruit by Itoo Keiske, Siebold, and Textor.

93. C. RUTHENICUM, Lindb. l. c. p. 248.—*Hypnum spectabile*, Wils. Bryol. Brit. 382.

Chiusenji, barren, *Bisset*.

Hypnum dendroides from Mannigusa and Koja, Thunb. Fl. Jap. 343, is probably *C. japonicum*.

DOZYA, Van der Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 296.

94. D. JAPONICA, *ejusd.* l. c.

Collected with a single deoperculate capsule by *Textor*.

Compared by the author to *Leucodon* and *Astrodontium*, from which it differs in its nerved leaves and plicate capsule, which was without peristome.

A fine species from China, with old and deoperculate fruit, seems to belong to the following genus.

ŒDICLADIUM, Mitt.

95. Œ. SINICUM, sp. n. Dioicum? Caulis primarius repens, ramis assurgentibus plagas latas efformans plerisque bi- tri-furcatis rectiusculis curvatisve. Folia nitida ubique tereti-imbricata patentia, in apicibus ramorum in gemmam clausam tecta, late ovalia, profunde excavata, lævia triplicatave, marginibus incurvis subintegerrimis, basi contracta brevissime binervata, apice subito in acumen subulatum rectum minute serrulatum angustata, e cellulis angustis lævibus basalibus ad angulos vix diversis areolata. Perichætia ad ramorum latera parva foliis convolutis. Theca in pedunculo concolore fusco-rubra nitida, ovalis, erecta, æqualis, peristomio vetusto dentibus solidis flavis asperulis haud trabeculatis.

Tsus Sima, *Wilford*.

Rami 2–3-unciales, sæpe divisi, æqualiter foliati, 2 mm. crassi. Folia cum acumine vix 3 mm. longa, pagina tenuis pellucida, plicis distinctis aut in eodem ramo carentibus. Pedunculus 7 mm. longus, gracillimus, parum flexuosus. Theca 2 mm. longa.

PTEROBRYUM, Hornsch.

96. P. ARBUSCULA, sp. n. Rami inferne simplices stipitiformes, exinde in frondem sub-

lanceolatam ramulis approximatis simplicibus divisisve pinnatim ramosi. Folia ramea erecto-patentia ovata, inde in acumen elongatum loriforme planiusculum, apice latiusculum acutum, margine serrulatum producta, subplicata, nervo infra apicem evanescente, e cellulis angustis areolata; ramulina conformia, magis patentia. Perichætia foliis internis ovatis in acumen tenue serrulatum producta. Theca immersa ovata, operculo conico acuminato, peristomio parvo.

Fertile specimens, '*Challenger*' *Exp.*; Kintoki, Hakone, barren, *Bisset.*

Rami frondiformes 1½–3-unciales, parte stipitiformi unciali, foliis appressis, in medio frondis cum foliis 2 mm. lati. Folia fusco-viridia, siccitate parum mutata, longitudinaliter subplicata, apicibus semitortis tortisve. Perichætia ad os thecæ 3 mm. longa. Theca 1 mm. longa. Peristomium e dentibus teneris, lamina interna obsoleta.

Very closely resembling the West-Indian and S.-American *P. angustifolium*, in size, ramification, and colour, with the same substriate leaves, which are not hollowed out as is so generally the case among the species of this genus. The Japanese species has the upper portion of its leaves more strap-like, more distinctly denticulate, and generally twisted, and the capsule is not so deeply immersed.

97. PTEROBRYUM FASCICULATUM, sp. n. Rami brevissime stipitati, ramulis pluribus approximatis pinnati subfasciculati. Folia imbricata patentia ovalia caviuscula, basi angulis ventricosis densissime areolatis carnosulis subauriculata, apice in acumen breve canaliculatum subserrulatum integerrimumve contracta, longitudinaliter subplicata, fere lævia, nervo medio evanido, margine late implana rectave, cellulis angustis areolata.

Barren stems, '*Challenger*' *Exp.*

Rami 1–1½-unciales, ramulis 1–1½ cm. longi, cum foliis 2 mm. lati. Folia fusco-viridia, sicca subnitentia.

The specimens appear to be a small state of a species similar to the African *P. Hanningtoni*, more dense in foliage than the Javan *P. convolutum* and with wider leaves.

Duby's *P. imbricatum* will be found under *Climacium japonicum.*

METEORIUM, Brid.

Sect. *Eumeteorium.*

98. M. PENSILE, sp. n. Rami penduli flexuosi, ramulis variis curvatis ramosi. Folia patentia dense inserta basi sese amplexantia, late cordato-ovata, alis basalibus convolutis, inde margine recurva flexuosa in acumen subulatum apice capillari contracta, nervo supra medium evanido, margine tenuissime serrulata, apice integerrima, e cellulis parvis angustis carnosulis obscuriusculis areolata. Flores masculi gemmæformes, antheridia septem satis magna includentes.

A few stems which appear to have grown in a pendulous manner, '*Challenger*' *Exp.*

Rami 6–10 cm. longi, ramulis cum foliis vix 2 mm. crassis. Folia stramineo-viridia fuscescentia, haud nitida, neque opaca, sicca parum mutata.

In appearance similar to *M. patulum* and other allied S.-American species; but with

foliage destitute of gloss, not, however, obscured with papillæ, as so frequently seen in species of this genus.

Sect. *Aerobryum*, Dozy et Molk.

99. METEORIUM WALLICHII.—*Hypnum Wallichii*, Brid.

A few fragments which seem to belong to this species, '*Challenger*' *Exp.*

It is included in Van der Sande-Lacoste's enumeration from *Siebold.*

Lindberg also enumerates this species from Nagasaki, and it is found in Hong Kong.

Sect. *Trachypus*, Schwaegr.

100. M. HUMILE.—*Trachypus humilis*, Lindb. in Act. Soc. Sci. Fenn. x. (1872) p. 230.

Nantaizan, barren, *Bisset.*

101. M. FLORIBUNDUM, Dozy et Molk. Musc. Frond. Archip. Ind. et Jap. 162, t. liii., was from Japan.

LASIA, Brid.

102. L. FRUTICELLA, sp. n. Caulis primarius repens. Rami ramulis plurimis inordinatis arbusculoso-ramosi substipitati. Folia imbricata subcompressa, lateralia patentia ovata, apice lata obtusiuscula semitorta, ramulina acuta, apice minute crenulata, margine inferiore recurva integerrima, nervo concolore medio evanido, cellulis ubique distinctis rotundatis minutis ad angulos pluribus minoribus; perichætialia triplo longiora pallida erecta, tria interna convoluta late ovata, e cellulis elongatis areolata, subito in acumen lanceolatum apice crenatum contracta. Theca in pedunculo brevi rubro ovalis, operculo in rostrum dimidiam thecæ longitudinis acuminato. Calyptra albida, apice viridis.

Chiusenji, *Bisset.*

Caulis repens parsque inferior ramorum foliis emortuis denudatus. Rami unciales, supra medium in ramulis irregularibus 2–8 mm. longis tenuibus divisi. Folia minuta obscure viridia, ramulina lateralia apicibus semitorta verticalibus. Pedunculus 4 mm. longus. Theca cum operculo 2 mm. longa.

In size and in the dull green colour very much like *Anomodon tristis.* It is allied to the *Lasia indica* (*Pterygynandrum indicum*, Mont.) and to the African *L. producta*, Hornsch.; but quite distinct in the broad points of its leaves.

NECKERA, Hedw.

103. N. LINGULATA, sp. n. Rami inferne in frondem flabelliformem divisi elongati, inordinatim subpinnati, ramulis patentibus. Folia compressa, lateralia patentia, omnia oblongo-linguæformia, fere ubique æquilata, apice rotundata, ibique minute crenulata, hic illic caviuscula, sicca indistincte 1–2 undulata, nervo brevi lato subramoso, cellulis apicalibus parvis rotundatis, in folii medio ovali-rotundis, inferne ad latera basalia pluribus minutis rotundis areolata.

Barren stems only, Nikko, *Bisset.*

Rami triunciales, ramulis lateralibus, semiunciam vix superantibus, cum foliis 2 mm. lati. Folia inferiora fusca, apicalia tantum viridia, lævia, vix nitentia, firma.

Intermediate in appearance between the Madeiran *N. intermedia*, Brid., and *N. lævigata*, Hook. f. & Wils. Fl. N. Zealand, more nearly resembling the first; all these species are remarkable for their very obtuse and very slightly undulated leaves.

104. NECKERA HUMILIS, sp. n. Monoica. Rami humiles, pinnatim ramosi. Folia compressa, dorsalia tumide imbricata ovata obtusiuscula excavata, lateralia patentia ovalia acuta complicata cochleariformi-concava, apicem versus transverse rugulosa, integerrima, nervo tenuissimo ultra medium producto, cellulis apicalibus rotundis, inferioribus ovalibus, basalibus ad angulos condensatis, omnibus minutis parietibus pellucidis; perichætialia erecta ovali-lanceolata convoluta. Theca immersa ovali-oblonga, operculo conico acuminato, peristomio dentibus angustis attenuatis. Calyptra parva dimidiata pilosa.

On bark in very small quantity, '*Challenger*' *Exp.*

Rami vix unciales, ramulis brevibus, cum foliis 2 mm. lati. Folia pallide viridia nitida, siccitate vix mutata, ætate fusca.

The appearance of this Moss is like that of young *N. crispa.*

105. N. PUSILLA, sp. n. Rami breves, inordinatim pinnati. Folia compressa subsecunda, lateralia patentia uno latere complicata, dorsalia oblonga ovaliave, inde elongata, latiuscule acuta, omnia lævia, margine apicem versus minute serrulata, breviter binervata, cellulis apicalibus ovalibus, inferioribus longioribus elongate oblongis. Perichætium foliis erectis convolutis ovato-lanceolatis acuminatis, thecam oblongam ad medium usque tegentibus.

A very few stems creeping on bark, with short free branches, '*Challenger*' *Exp.*

Rami vix 2 cm. longi, cum foliis 2 mm. lati, ramulis pluribus irregularibus. Folia lævia, nitida.

The very incomplete specimens show this species to be in foliage somewhat like *N. complanata*; but the capsule is almost immersed. The *N. complanata* in Miq. Ann. Mus. Bot. Lugd. Bat., gathered in a barren state by Siebold, may belong to this.

106. N. PENNATA, Hedw.

A single fructified stem, *Textor.*

HOMALIA, Brid.

107. H. NITIDULA, Mitt. in Journ. Linn. Soc., Bot. viii. 155.

A few fragments, '*Challenger*' *Exp.*; in the same condition amongst other Mosses, *Bisset*; originally from Nagasaki by *Oldham.*

108. H. APICULATA, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 296; Dozy et Molk. Musci Fr. ined. Archip. Ind. et Japon. t. 52 B, sine nom., diagnosi, aut loco natali.

Japan, *Siebold* and *Textor.*

This from the figure appears much larger than the preceding, but may be the same better grown.

POROTRICHUM, Brid.

Sect. *Euporotrichum.*

109. P. JAVANICUM.—*Neckera javanica*, C. Muell.

Two small stems, '*Challenger*' *Exp.*; also by *Bisset.*

Too incomplete to be conclusive.

110. P. FLABELLATUM, Mitt.—*Hookeria flabellata*, Sm., and also

111. P. SCALPELLIFOLIUM, Mitt.—*Neckera scalpellifolia*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 119; Dozy et Molk. Bry. Jav. ii. t. 180, are both enumerated by Miquel as collected by *Textor* and *Siebold* in a barren state only.

112. P. CYMBIFOLIUM.—*Isothecium*, Sect. *Dolichomitra*, Lindb. in Act. Soc. Sci. Fenn. x. (1872) p. 231.

Gathered at Nagayama in Kiusiu by *Maximowicz.* Seems to belong here; its leaves are described as very concave, and its capsule erect on a long seta.

Sect. *Thamnium*, Schimp.

113. P. SUBSERIATUM.—*Neckera subseriatum*, Dozy et Molk.

In a small and young state, '*Challenger*' *Exp.*; Nagasaki, *Oldham*; Ichmosawa and Senkokuhava, *Bisset.* Collected also in Buffalo Bay, China, by *Alexander.* All the specimens barren.

Lindberg had this species from Nagasaki, and at that time referred it to *Isothecium*, and supposed it to be the same as *T. subserratum*, Hook. *Thamnium subneckeroides*, Geheeb in Herb. Schimp., has been compared by Mr. C. H. Wright, and found to be the same species.

114. P. PLICATULUM, Mitt.—*Thamnium plicatulum*, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 299.

Collected by *Siebold.*

A smaller species, with complanate branches, on which the leaves are strongly serrate.

RHAPHIDORRHYNCHUM, Schimp.

115. R. DEMISSUM, Mitt.—*Hypnum demissum*, Wils.

Recorded from S. Japan, collected by *Textor*; Sande-Lacoste in Ann. Mus. Bot. Lugd. Bat. iv. 308.

116. R. THELIDICTYON, Mitt.—*Hypnum thelidictyon*, Sull. et Lesq.

Hill-sides, Ousima, *Amer. Explor. Exp.*

Described with oblong acuminate leaves constricted at base, alary cells conspicuous, margin serrate, cells unipapillate, operculum of oblong subpendulous fruit very long pointed; seems to be of this group.

ISOPTERYGIUM, Mitt. in Journ. Linn. Soc., Bot. xii. (1869) 497.

117. I. TEXTORI, Mitt.—*Rhynchostegium Textori*, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 299.

In close depressed tufts, with immature fruit, '*Challenger*' *Exp.*

118. I. FLACCIDUM, Mitt.—*Hypnum flaccidum*, Sulliv. et Lesq.

Simoda, *Amer. Explor. Exp.* On rotten wood, '*Challenger*' *Exp.*

119. I. SMALLII, Mitt.—*Hypnum Smallii*, Sulliv. et Lesq.

Ousima and Bonin Is., *Amer. Explor. Exp.*

The description of this nearly agrees with *I. Textori.*

120. I. POHLLÆCARPUM, Mitt.—*Hypnum pohliæcarpum*, Sulliv. et Lesq., also

121. I. SUBALBIDUM, Mitt.—*Hypnum subalbidum*, Sulliv. et Lesq.

Both from Simoda; appear to belong here or to *Plagiothecium.*

HETEROCLADIUM, Bruch et Schimp.

122. H. TENUE, sp. n. Dioicum. Laxe cæspitosum. Caulis procumbens subrepens ramosus. Folia laxe inserta divaricata ovata cochleariformi-concava, in acumen subulatum producta, enervia, integerrima, dorso papillis grossis inspersa; perichætialia parva argute serrulata. Theca in pedunculo prægracili elongato oblonga horizontalis, peristomio *Hypni.*

Barren plants creeping on bark, '*Challenger*' *Exp.*; amongst *Entodon Sullivantii*, Nikko, male plants only, *Bisset.* Intermixed with other Mosses, with old fruit, *Maries.*

Caulis 1–2 cm., ramis 3 mm. longis inordinatis, cum foliis mm. dimidium latitudine vix attingens. Folia minuta obscuriuscula, cellulis ovalibus, papilla magna medio imposita obscuratis, areolata. Pedunculus 1 cm. altus, ruber. Theca minuta, peristomio valido. Flos masculus satis magnus, gemmiformis.

One of the most minute of completely peristomate Hypnoid Mosses; it is allied to the Indian *Hypnum inflexum*, Harv., in its foliage, and its horizontal capsule is of the same form; it is also allied to those Mosses which are placed in the genus *Myurella*, and which differ from *Heterocladium* in aspect rather than in any essential character.

123. H. LEUCOTRICHUM, sp. n. Caulis procumbens, ramis simplicibus assurgentibus erectisve pinnatim ramosus. Folia appresse imbricata, a basi late ovata cochleariformi-concava, margine ubique recurva integerrima, subito in apiculum angustum longitudine folium superantem, a medio e cellulis elongatis uniseriatis hyalinis angustissimis conditum, producta, nervis fere obsoletis, cellulis minutis ovalibus, parietibus æquilatis limpidis lævibus areolata.

Creeping amongst the stems of *Tetraplodon mnioides* and *T. angustatus*, Nantaizan, *Bisset.*

Caulis 3 cm. longus, ramis ut plurimis 1 cm. brevioribus. Folia cum pilo 1 mm. parum excedentia.

The place of this curious small species must remain uncertain until a more complete state is discovered; it is a little more robust than the *Pterogonium perpusillum*, De Not., and quite different from any of the allied small species in its long hyaline leaf-points.

MYURELLA, Bruch, Schimp. et Guemb.

124. M. CONCINNA, Lindb. in Act. Soc. Sci. Fenn. x. (1872) 275.—*Hypnum concinnum*, Wils. in Lond. Journ. Bot. 1848, 277, t. 10, C; *Hypnum Maximoviczii*, Borszczow, Maxim. Prim. Fl. Amur. p. 467.

Nikko, *Bisset.*

HYOCOMIUM, Schimp.

125. H. CAPILLIFOLIUM, sp. n. Cæspitosum. Depressum. Rami breviusculi, inordinatim pinnati, conferte ramosi. Folia patentia, sicca immutata, a basi cordato-ovata, sensim longissime piliformi-attenuata, enervia, e cellulis angustis areolata, margine tenuissime serrulata; perichætialia conformia, acumine longiore. Theca in pedunculo rubro inclinata oblonga.

Small specimen with old fruit, '*Challenger*' *Exp.*

Rami 2–3 cm. longi, ramulis variis 1 cm. vix excedentibus. Folia dense inserta, plumosa, stramineo-viridia, nitida, sicca striatula. Pedunculus circiter 8 mm. longus. Theca satis parva, 1 mm. longa, cinnamomea.

Very near to *H. hastile* (*Stereodon hastilis*, Mitt. in Journ. Linn. Soc., Bot. viii. 153), gathered by *Oldham.* It has the same irregular ramification and patent foliage; but appears to be a more compactly growing Moss, with longer and wider leaves attenuated into a hair-like point. Both the Japanese species agree closely with the Indian *H. lychnites*, Mitt. (*Stereodon lychnites*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 114), and the Australian *H. pilosum*, having the foliage neither falcate nor secund, as in the European *Ctenidium molluscum*, Mitt. in Journ. Linn. Soc., Bot. xii. (1869) 509 in obs. (*Hypnum molluscum*, Hedw.), as known in its common state; but there are other states even of this species in which the leaves are all straight, and thus the stems are destitute of the distinctive appearance which alone separates it from *Hyocomium.*

126. H. EXALTATUM, sp. n. Caulis procumbens, pinnatus. Folia compressa, lateralia divergentia ovata, sensim in acumen sinuato-flexuosum angustata, margine remote serrulata, nervis binis medio evanidis, cellulis angustissimis ad angulos paucissimis abbreviatis inconspicuis areolata, ramea divergenti-incurva oblongo-ovalia, apice excavata, inde in acumen elongatum planum remote serrulatum flexuosum producta, margine inferiore anguste implana; perichætialia elongata anguste attenuata, integerrima. Theca in pedunculo prælongo ovalis horizontalis, operculo depresse conico, mamilla crassa.

Hakone Pass, *Bisset.*

Caulis biuncialis, cum ramis semiunciam latus, cum foliis 2 mm. latus. Folia 2 mm. longa, compage tenera cellulis perangustis, sicca nitida straminea aureaque. Pedunculus 3–4 cm. altus.

127. HYOCOMIUM RUGINOSUM, sp. n. Dioicum? Caulis procumbens, pinnatim ramosus. Folia laxe compressa, lateralia a basi divergente incurva, dorsaliaque laxe imbricata ovata excavata, in subulam latiusculam flexuosam acuminata, margine serrulata, versus apicem sinuata flexuosa, nervis angustissimis binis brevibus, cellulis angustissimis finitibus dorso prominulis, alaribus paucis minutis rotundatis concoloribus areolata; perichætialia apicibus loriformibus serrulatis. Theca in pedunculo elongato gracillimo ovalis inæqualis horizontalis, operculo depresse conico mamillato.

With fruit nearly mature in Sept., Nikko, *Bisset*; Simla, *Griffith*, 89, 471, 92; also gathered in India by *Bell.*

Caulis biuncialis longiorve, ramis pinnatim dispositis, ramulis approximatis fasciculatisve interdum remotis, cum foliis 2 mm. latus. Folia viridia, aureo-rufescentia, nitida, mollia. Pedunculus 3 cm. altus. Theca cum operculo 2 mm. longa.

Smaller than *H. Berthelotianum*, with softer leaves and more branched stems.

Another Indian species of this group is

H. CYLINDRICARPUM, sp. n. Dioicum? Caulis procumbens, ramis assurgentibus pinnatis vagisve, ramosus. Folia subcompressa patentia, laxe appresseque imbricata, ovali-lanceolata acuminata ovaliave, excavata, in acumen subulatum inferne sinuato-flexuosum producta, usque ad medium anguste binervata, cellulis angustissimis ad angulos paucis abbreviatis concoloribus inconspicuis areolata, ramea conformia, apicalia subcuspidatim imbricata; perichætialia elongata, apicibus piliformi-attenuatis integerrimis. Theca in pedunculo elongato, apice curvato, oblongo-cylindracea, æqualis, horizontalis, peristomio stereodontis ciliis singulis.

Bhotan, Tongsa, alt. 10,000, *Griffith*; gathered also by *Bell.*

Caules ramive biunciales, interdum usque ad quadriunciales, ramulis semiuncialibus patentibus ramosi, cum foliis 2 mm. lati. Folia 2 mm. longa, compage tenuissima, flaccidula. Pedunculus 3 cm. longus. Theca 3 mm. longa, 1 mm. crassa.

Entire Moss fulvous brown. Foliage soft. Theca remarkably long. About the size of *H. Berthelotianum*, but compressed. The specimens appear to have grown in a locality exposed to great humidity.

PLAGIOTHECIUM, Bruch et Schimp.

128. P. NECKEROIDEUM, Schimp.

Bisset; mentioned also by *Sande-Lacoste.*

129. P. SILESIACUM, Bruch et Schimp.

'*Challenger*' *Exp.*; also by *Maries.*

130. P. LONGISETUM, Lindb. in Act. Soc. Sci. Fenn. x. (1872) 232.

Nicosan, Kiusiu, *Maximowicz.*

131. P. NEMORALE, Mitt.—*Stereodon nemoralis*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 104.

Barren stems, Miogisan, *Bisset.*

132. PLAGIOTHECIUM DENTICULATUM, Bruch et Schimp.—*Hypnum denticulatum*, Linn.

133. P. SYLVATICUM, Bruch et Schimp.—*Hypnum sylvaticum*, Linn.

These are both enumerated in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 300.

ENTODON, C. Muell.

134. E. ABBREVIATUS, sp. n. Monoicus. Rami depressi, breves, fasciculatim divisi. Folia distiche complanata, lateralia patentia ovalia acuta cymbiformi-concava conduplicata integerrima, brevissime binervia, cellulis angustis basalibus ad angulos quadratis pellucidioribus areolata; perichætialia erecta, elongata, lanceolata, sensim attenuata. Theca in pedunculo brevi fusco ovali-cylindracea, leptoderma, ore aurantiaco, peristomio brevi dentibus processibusque angustis aurantiacis, annulo persistente circumdata.

In depressed tufts with old fruit, '*Challenger*' *Exp.*; gathered also on rotten wood by *Maingay.*

Rami circiter 2 cm. longi, ramulis 3–4 mm. longis remotis, cum foliis 2 mm. latis. Folia mollia subnitentia viridia. Pedunculus 8 mm. longus. Theca 2 mm. longa, tenera; columella brevis.

A small, compact species, remarkable in the few specimens for its short inconspicuous stems and branches, so compressed as to be wider than those of *E. brevisetus*, Mitt. (*Neckera breviseta*, Hook. et Wils.), or *E. Drummondii*, Mitt. (*Cylindrothecium Drummondii*, Schimp.).

135. E. ATTENUATUS, sp. n. Monoicus. Rami procumbentes inferne simplices, medio ramis paucis, pinnati. Folia compressa, lateralia patentia ovata ovali-ovatave, subenervia, apice subacuta, integerrima, ramulina ultima angustiora, apice pauciserrulata, subintegerrima, cellulis angustis basalibus ad angulos quadratis areolata; perichætialia erecta elongata, apicibus elongatis subulatis integerrimis. Theca in pedunculo rubro cylindracea, operculo rectirostrato tertiam thecæ longitudinis æquante.

Ikegama, Hakone, and Nikko, *Bisset*; gathered also by *Maries.*

Rami laxe cæspitosi 3–4 cm. longi, apicibus interdum stoloniforme attenuatis radicantibusque; ubi latiores cum foliis 2 mm. lati, ramulis 1 cm. longis. Folia pallide viridia stramineaque subnitentia. Theca in pedunculo unciali fusca, 2 mm. longa, recta subcurvatave.

This species is near to *E. Sullivantii*, Lindb. (*Neckera Sullivantii*, C. Muell.); but has narrower leaves, and in this particular differs from all the described Indian species except the *E. pulchellus*, Mitt. (*Neckera pulchella*, Griffith)=*E. lætus*, Mitt. (*Stereodon lætus*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 107).

136. E. RAMULOSUS, sp. n. Dioicus. Rami procumbentes inferne substipitati, deinde in frondem lanceolatam elongatamve, ramulis approximatis bipinnatam, ramosi. Folia compressa, lateralia patenti-incurva ovato-lanceolata caviuscula, tenuissime binervia, integerrima, ramulina ultima parva elliptica, apicibus pauciserrulatis recurvulis, omnia cellulis elongatis basi, ad angulos paucis quadratis areolata; perichætialia erecta elongata, apicibus breviter subulatis. Theca in pedunculo rubro cylindracea, operculo rectirostrato tertiam thecæ longitudinis æquante.

Ikegama, Nikko, and Hakone, *Bisset*; with *E. Sullivantii*, '*Challenger*' *Exp.*

Rami sesquiunciales longiusve producti, ramulis plurimis 1 cm. longis inferne iterum

ramosis bipinnati, cum foliis ubi latiores 2 mm. lati. Folia pallide viridia stramineaque nitentia. Pedunculus sesquiuncialis. Theca 3 mm. longa, cinnamomea.

This, in its bipinnate ramification, agrees only with the Indian *E. rubicundus*, Mitt. (*Stereodon rubicundus*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 108), and differs from it in being more slender. Both this and *E. attenuatus* have a great similarity to *E. Sullivantii*, so that, as in the case of the species found in America, unless closely examined it is very easy to confound species which are really quite distinct.

137. ENTODON COMPRESSUS, Mitt.—*Leskea compressa*, Hedw.

Is mentioned by Sande-Lacoste as having been collected abundantly in fruit by *Textor*.

138. E. SULLIVANTII, Lindb. in Act. Soc. Sci. Fenn. x. (1872) 233.—*Neckera Sullivantii*, C. Muell. Syn. ii. 65.

'*Challenger*' *Exp.*; mentioned also by *Lindberg*, l. c.

PYLAISIA, Schimp.

139. P. POLYANTHA, Bruch et Schimp.

Gathered by *Texor*.

140. P. ? ERECTIUSCULA, Mitt.—*Hypnum erectiuscula*, Sulliv. et Lesq. in Proc. Amer. Acad. iv. p. 281.

Hakodate, *Amer. Expl. Exp.*

May belong here; the capsule is described as "erectiuscula"; peristome not mentioned: or its place may be in *Plagiothecium*.

Another species which appears to belong to this genus is:—

P. NANA, sp. n. Monoica. Procumbens, ramosa. Folia subcompressa patentia, a basi angusta, ovato-lanceolata, sensim angustata, caviuscula, integerrima, breviter binervia, cellulis angustis ad angulos pluribus parvis rotundatis condensatis; perichætialia majora subconformia. Theca in pedunculo brevi ovalis erecta, operculo conico obtuso, peristomio dentibus pallidis, processibus in membrana brevi latiusculis fuscis obscuriusculis, ciliis nullis.

Tsus Sima, on bark amongst *Frullania*, *Wilford*.

Caulis vix 2 cm. longus, ramis paucis inordinatis 3–5 mm. longis, cum foliis 2 mm. latus. Folia stramineo-fulva, vix nitida. Pedunculus 5 mm. longus. Theca 1 mm. longa.

STEREODON, Brid.

141. S. ADNATUS, Brid.—*Hypnum adnatum*, Hedw.

With perfect fruit, '*Challenger*' *Exp.*

142. S. REPTILE, Mitt.—*Hypnum reptile*, Rich.

Recorded in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 300.

143. S. OLDHAMI, Mitt. in Journ. Linn. Soc., Bot. viii. 154.

Barren, '*Challenger*' *Exp.*; Nagasaki, *Oldham*; Sbinano, *Bisset*, also by *Maingay*; Chusan, China, *Wilford*.

Lindberg mentions doubtful specimens of *S. imponens*, Brid.

144. STEREODON PLUMÆFORMIS, Mitt. in Journ. Linn. Soc., Bot. viii. 154.—*Hypnum plumæforme*, Wils. in Hook. Lond. Journ. Bot. vii. (1848) 277, t. 10.
Well fruited specimens, *Prof. Thomson.*

145. S. CIRCINALIS, Brid.—*Hypnum circinale*, Hook. Musc. Exot. t. 107.
With old fruit, '*Challenger*' *Exp.*, also by *Maries*; Fujisan, *Bisset.*

146. S. INCURVATUS, Mitt.—*Hypnum incurvatum*, Schrad.
On dead wood, with capsules just mature, Chiusenji, *Bisset.*

147. S. CURVIFOLIUS, Brid.—*Hypnum curvifolium*, Hedw.
Bisset, also by *Siebold* and others (Miq. Ann. Mus. Bot. Lugd. Bat. iv. 188).

148. S. HALDANIANUS, Mitt.—*Hypnum Haldanianum*, Grev.
Chiusenji and Hakodate, the lakes, with old fruit in December, *Bisset.*

149. S. HENONI, Duby in Flora, (1877) 93.
On a wall, Yama Goutchi, *Dr. Henon.*

The description answers well to a species of this group, and it is possible it may belong to *S. Haldanianus*, so often mistaken from its uncertain aspect.

150. S. BRACHYCARPUS, sp. n. Monoicus. Caulis procumbens, ramulis approximatis iterum ramosis, bipinnatus. Folia subcompressa patenti-incurva; caulina inferne ovata, in acumen elongatum, apice latiusculum, planum, denticulatum producta, breviter binervia, cellulis angustis ad angulos basales pluribus subquadratis majoribus pellucidis aurantiacisque, ramea apicibus magis denticulatis; perichætialia apicibus patentibus latiusculis denticulatis. Theca in pedunculo elongato inclinata ovalis gibba, operculo depresse conico acuto.

Nantaizan, fruit mature in Sept., *Bisset.*

Caulis 1–2-uncialis eleganter decrescenti-pinnatus subfasciculatimve ramosus. Folia viridia nitida fuscescentia, appresse imbricata, recta, vel in apicibus caulium ramorumque secunda. Pedunculus 2 cm. longus. Theca vix 2 mm. longa, 1 mm. lata.

A little less than *S. affinis*, Mitt., and *S. bipinnatus*, the ramuli more close and the capsule very different.

There is another Indian species which comes nearer in size:—

S. CONFINIS, sp. n. Monoicus. Caulis procumbens pinnatus, apicibus sæpe procurrentibus. Folia subcompressa erecto-patentia, apicalia secunda falcataque, caulina ovato-lanceolata, ramea oblongo-lanceolata caviuscula, apicibus latis planis denticulatis, nervis inconspicuis, cellulis angustis alaribus conspicuis oblongis quadratisque pellucidis aurantiacisque; perichætialia patentia, apicibus latis denticulatis. Theca in pedunculo elongato suberecta inclinatave, oblongo-cylindracea, operculo conico acuto.

Bhotan, alt. 6000–10,000 ft., in shady woods, on trees, Bailfa and Tongsa, *Griffith*, 595.

S. affinis paululum gracilior, caulibus inordinatim pinnatis.

HYLOCOMIUM, Schimp.

151. H. VARIANS, sp. n. Caules depresse cæspitosi, pinnati, ramis variis gracilibus attenuatis, apicibusve foliis subito duplo majoribus dilatatis. Folia dorso imbricata, compressa, lævia, lateralia patenti-divergentia, apicibus varie curvatis, late ovata acuta, in ramorum cauliumque apicibus ubi majora subcuspidata, minora oblongo-ovata ovali-lanceolataque, omnia nervis binis medio evanidis, marginibus minute sed argute serrulatis, cellulis anguste oblongis, superioribus spiculis minutis dorso prominulis inspersis.

Kintoki, Hakone, *Bisset.*

Caules 3–4 cm. longi, ramis longioribus 1 cm. metientibus. Folia minora 1 mm., majora 2 mm. longa, stramineo-viridia, haud nitentia, seniora fulva fuscaque.

A curious Moss, with compressed foliage of very irregular form, size, and direction, unlike any species of *Hylocomium* except *H. triquetrum*, which has the same kind of spiculate cells on the back of the upper portions of its leaves.

152. H. TRIQUETRUM, Schimp.—*Hypnum triquetrum*, Linn.

Fragments, *Siebold.*

153. H. BREVIROSTRUM, Schimp.—*Hypnum brevirostre,* Ehrh.

Male plant only, '*Challenger*' *Exp.*

154. H. CAVIFOLIUM, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 373.

Collected in very small quantity by *Textor.* A single stem amongst packing material sent with *Diospyros Kaki.*

Almost exactly like *H. brevirostre*; but without paraphylla, and the leaves quite smooth or rarely plicate.

155. H. CALVESCENS, Mitt.—*Hypnum calvescens,* Wils. Bryol. Brit. 387; *H. subpinnatum*, Lindb.

Hakone Pass and Fujisan, with mature fruit in October, *Bisset.* Recorded also by Lindberg and Sande-Lacoste.

156. H. SQUARROSUM, Schimp.—*Hypnum squarrosum,* Linn.

Sterile, *Siebold.*

H. Flemmingii, Austin in Bull. Torrey Club, v. 24 (Lesq. et James, Manual, 410), is correctly placed in this group by Austin, but it is identical with *Hypnum robustum,* Hook. Musc. Exot. 108!

157. H. SPLENDENS, Schimp.—*Hypnum parietinum,* Thunb. Fl. Japon. 342.

Gathered sterile by *Siebold.*

H. umbratum, Schimp., also sterile, is mentioned by Sande-Lacoste from *Siebold.*

158. H. HIMALAYANUM, Mitt.—*Stereodon himalayanum,* Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 113.

Kintoki, *Bisset.*

Fruit of this fine large species is unknown.

159. HYLOCOMIUM SCHREBERI, Mitt.—*Hypnum Schreberi*, Willd.

Nantaizan, Chiusenji, Fujisan, and Yumoto, all barren, *Bisset*.

HYPNUM, Dill.

Sect. *Eurhynchium* et *Rhynchostegium*, Schimp.

160. HYPNUM PURUM, Linn., is reported sterile from *Siebold*.

161. H. PRÆLONGUM, Linn.

A few stems amongst other Mosses, '*Challenger*' *Exp.* With deoperculate capsules in February, *Maries*.

H. prælongum is a species of very wide distribution, and is found in N.W. America with its capsules abruptly bent down and more or less evidently ventricose, as is usual in European specimens; but in the few plants seen from Japan the capsules have a different appearance, being only a little inclined and not ventricose, and the leaves of the main stems are not divergent; in other particulars they correspond with the usual states.

H. hians, Hedw., gathered in fruit by *Thunberg*, and sterile by *Textor*, is mentioned by Sande-Lacoste.

162. H. POLYSTICTUM, sp. n. Dioicum. Caulis procumbens, pinnatim ramosus. Folia laxe patentia patulave, caulina cordato-ovata, sensim in acumen angustum subulatum producta, ramea compressa ovata vix acuminata, apice latiuscula acuta planiuscula, nervo infra apicem in denticulo dorso exstante producto, margine ubique serrulata, cellulis angustissimis apicibus in punctis dorso elevatis productis. Perichætium magnum, foliis internis in subulam angustam elongatam recurvam minus serrulatam eductis. Pedunculus elongatus, ubique asperrimus, apice arcuatus. Theca horizontalis cernuave oblonga, operculo subulato-rostrato. Peristomium normale.

Received amongst packing material with *Diospyros Kaki*.

Caules triunciales longioresve, ramis semiuncialibus strictis curvatisve. Folia fusco-viridia subnitentia, siccitate parum mutata. Pedunculus sesquiuncialis, fusco-ruber, crassiusculus. Theca basi inæqualis fusca.

Near to the *Hypnum oreganum*, Sulliv., from N.W. America; but less densely pinnate, with narrower leaves, and the capsule not ovate and pendulous. It is also nearly allied to *H. Swartzii*, Turn., in size; but different in its interruptedly branched arcuate stems and the form of its cauline leaves.

163. H. LONGIFOLIUM, sp. n. Habitus staturaque *H. longirostri*, foliis autem caulinis a basi subovata plicata sensim late subulatis, apice angustissimis, nervo ante subulam planiusculam evanescente, margine serrulata, rameis ovato-lanceolatis argutius serrulatis, omnibus e cellulis angustis areolatis.

One stem only, *Bisset*; fragments from Tsus Sima, *Wilford*.

Closely resembles *H. longirostrum*; but its leaves are 3 mm. long, with almost capillary points.

164. Hypnum pallidifolium, Mitt. in Journ. Linn. Soc., Bot. viii. 153.
Nagasaki, *Oldham*; Tsurumi, *Bisset*.
The seta in this is smooth.

165. H. inclinatum, Mitt. in Journ. Linn. Soc., Bot. viii. 152.
Ohossima, *Oldham*.
Seta rough.

Sect. *Homalothecium*, Schimp.

166. H. tokiadense, sp. n. Caulis procumbens, ramulis pluribus erectis ramosis. Folia ramea erecto-patentia, a basi cordata deltoidea, tenuissime subulata, margine ad angulos minutissime crenulata, alibi integerrima, nervo medio evanescente, quadriplicata, e cellulis minutis versus apicem angustis, inferioribus oblongis, basin versus pluribus abbreviatis densis obscurioribus areolata; ramulina erecto-patentia laxe imbricata, ovato-lanceolata, concava, bi- tri-plicata, apice vix vel brevi acuminata, latiuscula, minutissime serrulata, nervo infra apicem desinente, e cellulis perangustis oblongis basalibus condensatis areolata; perichætialia erecta subulata. Theca in pedunculo brevi erecta lævis, æqualis ovali-cylindracea, operculo subulato dimidiam thecæ longitudinis æquante. Peristomium parvum, dentibus angustis.

A small tuft of barren stems, '*Challenger*' *Exp*. With young fruit and old capsules, Nantaizan, *Bisset*.

Caulis procumbens 1–3 uncias longus, ramis plurimis semiuncialibus vel fasciculatim ramosus, ramulis semiunciam plerisque, brevioribus 2 mm. crassis. Folia viridia nitida, seniora ochracea. Pedunculus 1 cm. altus. Theca 2 mm., operculo 1 mm. longo.

A little more robust than *H. sericeum* and *H. philippianum*, but entirely of the same habit and appearance. The peristome is of the same kind; but the exact state of the internal peristome cannot be seen, and the calyptra is not present.

167. H. sciureum, sp. n. Caulis repens, ramis erectis. Folia ramea dense inserta patentia, a basi truncata, angulis parvis rotundatis, sensim angustata, lanceolato-subulata, plicata, margine minutissime serrulata, nervo in apicem evanescente, cellulis minutis angustis finitibus prominulis areolata; perichætialia longiora. Theca in pedunculo lævi rubro erecta (?), oblongo-ovalis, operculo fere æquilongo. Calyptra calva.

Hakone Pass, with fruit immature in October, *Bisset*.

Rami 2–3 cm. alti, cum foliis fere 3 mm. crassi, simplices, rarius furcati, in cæspitibus laxis aggregati. Folia vix nitida stramineo-viridia fuscescentia, sicca parum mutata, pluries plicata. Pedunculus 1 cm. longus. Theca 2 mm. longa.

A little more robust than *H. sericeum*, Linn., and almost destitute of the glossy foliage so evident in that species, and thus more nearly resembling the *Leskea Bonplandii*, Hook. Musc. Exot. t. lv., to which the Indian *Isothecium nilgiriense*, Mont. (*Pleuropus fenestratus*, Griff.), belongs, and of which a barren specimen was gathered on the city wall of Ningpo by *Oldham*.

H. macrostegium, Sulliv. et Lesq. in Proc. Amer. Acad. iv. p. 280, may be a species of

this group; it is described with leaves having an oblong-ovate base, gradually long-acuminate, plicate, serrate, a nerve almost percurrent, a cylindraceo-oval capsule, and a long-beaked operculum, the cilia of the internal peristome "subnullis." It was gathered at Simoda.

168. HYPNUM LÆVISETUM, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 298, p. 186, t. 1. Dioicum. Caule repente, stolonifero ramoso, ramis erectis pinnatis; foliis confertis erecto-patentibus ovato-lanceolatis, longitudinaliter profunde sulcatis, strictis, margine ubique denticulatis, costa infra apicem desinente; cellulæ elongatæ angustæ; perichætialibus internis oblongo-lanceolatis acuminatis, apice denticulatis; capsula in pedicello lævi purpureo erecta vel parum inclinata, oblonga, leptoderma; peristomio simplici, dentibus lanceolatis dense trabeculatis linea divisurali distincta.

Collected by *Textor*, locality not stated.

Compared with *H. sericeum*; and the characters agree nearly with those ascribed to *H. sciureum*, differing, however, in the pinnate branches and ovate lanceolate denticulate leaves. From the figure it appears to be a more slender species.

Sect. *Brachythecium*, Schimp.

169. H. PSEUDOPLUMOSUM, Brid.

Fertile specimens, '*Challenger*' *Exp.*; Joshin, Nikko, *Bisset*. Recorded also by *Siebold*, *Textor*, and *Pompe van Meerdervoort*.

170. H. CAMERATUM, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 78.

Nikko, *Bisset*.

The specimens agree nearly with those from India.

Sect. *Isothecium*, Brid.

171. H. DIVERSIFORME, sp. n. Dioicum. Fruticosum, stipite brevi subnullove, ramis pluribus inordinatis, sæpe stoloniformibus, vage pinnatim expansum. Folia majora patentia subcompressa, ovata, acuminata, nervo paulo ultra medium desinente, margine minute serrulata, ramea ovata ovaliaque acuta evidentius serrulata, sæpe uno latere inflexa, e cellulis angustis areolata; perichætialia ovato-lanceolata acumine longiore divergente integerrima. Theca in pedunculo brevi oblonga, erecta, cinnamomea, operculo acuminato, peristomio interno ciliis obsoletis.

With mature fruit, '*Challenger*' *Exp.*; in the same state, *Maries*. Fujisan with fruit past maturity in May, *Bisset*. Also in Tsus Sima, *Wilford*.

Habitus *H. myuro* similis, *H. myosuroidi* autem statura similior. Caules valde diversiformes, minores 1 cm. alti et fertiles, alii 4–8 cm. longi, arbusculosi. Pedunculus 1 cm. longus. Theca cum operculo 2 mm. longa, pulchre colorata.

Not like any of the species as yet known from N.W. America, except *H. acuticuspis*, Mitt., and this has a capsule almost horizontal.

Sect. *Ptychodium*, Schimp.

172. H. HAKONIENSE, sp. n. Dioicum. Caulis repens, ramis pluribus erectis simpli-

cibus. Folia dense inserta erecto-patentia, caulina ovata, sensim longe subulato-angustata integerrima, ramea ovato-lanceolata sensim angustata, acuta, subserrulata, nervo infra apicem evanescente carinata, cellulis superioribus oblongis limitibus latiusculis, inferioribus magis approximatis; perichætialia erecta subulato-attenuata. Theca in pedunculo lævi rubro ovalis, inclinata, subhorizontalis, inæqualis, operculo subulirostro thecam æquante. Calyptra nuda.

Hakone Pass, with young fruit in October, *Bisset.*

Cæspites depressi. Rami vix semiunciales, plus minus curvati, sæpe apicibus attenuatis. Folia luteo-viridia absque nitore, sicca plicata. Pedunculus semiunciam longus, ruberrimus, crassiusculus.

Closely similar to *Hypnum plicatum* in the colour and substance of its leaves, which are not so much plicate. No paraphylla have been seen.

The peculiar areolation of the leaves in *H. plicatum*, which separates it from the species allied to *H. lutescens*, is observable in *Lescurea striata* and *L. insignis*, and seems to indicate that these species stand in the same relation to *H. plicatum* that *H. sericeum* does to *H. lutescens.*

AMBLYSTEGIUM, Schimp.

173. A. PALUDOSUM, Mitt.—*Hypnum paludosum*, Sulliv. Icon. Musc. t. 101.

Barren stems, *Dickens.*

174. A. COMMUTATUM, De Not.—*Hypnum commutatum*, Hedw.

Enumerated by Miquel, Ann. Mus. Bot. Lugd. Bat. vii. 300.

175. A. CAPILLATUM, Mitt.—*Leskea capillata*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 130.—*Pseudoleskea intermedia*, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 297.

In spreading patches, with fruit just ripened, '*Challenger*' *Exp.*; also by *Dickens* and *Oldham*; Chiusenji, Miogisan, and Joshin, *Bisset.*

This with a number of similar species, chiefly Oriental, seem to agree better with the genus *Amblystegium* than with *Pseudoleskea* or *Thuidium.*

176. A. LATIFOLIUM, Mitt.—*Pseudoleskea latifolia*, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 185, 297, t. ii.

Gathered by *Textor* and *Buerger.*

Described as larger and more rigid than *A. capillatum.* A much smaller species is

A. COMPRESSUM, sp. n. Monoicum. Depresse cæspitosum. Caulis subpinnatim ramosus, procumbens. Folia late subcordata acuminata, nervo infra apicem desinente, ramea compressa lateralia divaricata, ovata, obtuse acuta, nervo concolore percurrente, cellulis minutis rotundatis papillis minutissimis obscuratis areolata; perichætialia elongata, pallida, cellulis elongatis subpellucidis. Theca in pedunculo rubro inclinata, curvula, oblonga, operculo conico.

China, *Wilford.*

Caulis subuncialis, ramis 2–4 mm. longis. Rami cum foliis 1 mm. parum latiores. Folia obscure viridia. Pedunculus 1 cm. longus. Theca cum operculo fere 2 mm. longa.

Much less than *Amblystegium capillatum*, and with short wide leaves.

ANOMODON, Hook. et Tayl.

177. A. ABBREVIATUS, sp. n. Habitus, statura, colorque *A. viticulosi.* Folia humida patentia, sicca appressa, dimidio inferiore ovata, superiore ligulata, apice rotundata obtusa, nervo concolore infra apicem desinente, margine integerrima e cellulis parvis rotundatis, haud opacis, brevissime papillosis, in folii medio ad nervi basin paucis pellucidioribus elongatis areolata; perichætialia caulinis breviora, apicibus angustis. Theca ovalis in pedunculo flavo vix eam longitudine superante exserta.

Joshin, *Bisset.*

Rami cum foliis expansis humidis 5 mm. lati, adspectu omnino cum *A. viticuloso* congruentes, 1½–3-unciales, curvati. Folia apicibus rotundatis integerrimis. Theca lævis, castanea, 1 mm. longa.

The short seta and rather small capsule render the fructification of this species very inconspicuous, and although the whole appearance of the stems and foliage is so similar to that of *A. viticulosus*, the leaves are differently shaped at their points, being more rounded and not crenulate; it does not so nearly resemble *A. apiculatus.*

178. A. RAMULOSUS, sp. n. *A. viticuloso* simillimus, foliis autem magis ligulatis, apicibus rotundatis integerrimis, nervo pellucido infra apicem desinente, cellulis superioribus fere opacis.

Nantaizan, *Bisset*; gathered also by *Maingay*; and in China on the city wall, Ningpo, by *Oldham.* All barren.

In all the specimens the stems are shorter and more branched than is usual in *A. viticulosus*, the leaves are more equally wide, the ligulate ends with shorter nerve and a more opaque areolation; the foliage on some stems is subcompressed; but the upper portions are much narrower than in *A. minor.*

179. A. PLANATUS, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 126.

A few small stems, barren, '*Challenger*' *Exp.*

In this species the nerve is always nearer to one side of the leaf, so that the leaves appear unsymmetrical in outline.

180. A. DEVOLUTUS, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 127.

Some small stems with other Mosses, '*Challenger*' *Exp.*; also collected by *Bisset.*

181. A. ACUTIFOLIUS, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 126.

Fragments, '*Challenger*' *Exp.*; Nantaizan, *Bisset.*

These specimens agree with the Indian, and agree also so closely in habit and general appearance with *A. attenuatus* that most probably they are all a state of one species.

182. A. TRISTIS, Mitt.—*Leskea tristis*, Cesati; *A. fragilis*, Wils., et *Leskea fragilis*,

Drum. M. Amer. No. 101; *Hypnum emarginatum*, Schleich.; *Haplohymenium Sieboldi*, Dozy et Molk. Musci ined. Archip. Ind. 127, t. xl.

Intermixed with Mosses; barren: '*Challenger*' *Exp.*

To the specimens distributed by Schleicher, of which several have been seen, he added on the labels "nova species suadente Swartz." This would appear to have escaped the notice of Bridel and succeeding authors, although Schleicher's collections are enumerated by Bridel amongst the authorities he had consulted (Bry. Univ. i. p. xxiv). There must be a locality for this small species in the region within which Schleicher collected.

LESKEA, Hedw.

183. L. DECURVATA, Mitt. in Journ. Linn. Soc., Bot. viii. 154.

Fragments among other Mosses, '*Challenger*' *Exp.*

184. L. PUSILLA, sp. n. Dioica. Repens. Folia patula a basi late ovata, sensim acuta, nervo supra medium desinente, e cellulis parvis rotundatis obscuris areolata; perichætialia erecto-patentia, lanceolata. Theca oblongo-cylindracea erecta subinæqualisve, operculo conico mamillato.

Creeping on bark, *Maingay.*

Caulis 1 cm. longus, cum foliis 1 mm. dimidiam vix latus. Pedunculus 1 cm. altus. Theca 1 mm. longa.

A very small species, with entirely the habit and appearance of the European *L. polycarpa*, Ehrh.

THUIDIUM, Schimp.

Sect. *Euthuidium.*

Caules camerati interrupti, ramulis bifariis.

185. T. JAPONICUM, Dozy et Molk. ex Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 297.

Barren specimens, *Prof. Thomson*; Nagasaki, *Oldham*; Hadogaya, Yokohama, *Bisset.* Also sent as packing-material with *Diospyros Kaki.*

186. T. GLAUCINUM, Mitt.—*Leskea glaucina*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. p. 133.—Dozy et Molk. Bry. Javan. ii. 117, t. ccxxii.

Small barren stems, '*Challenger*' *Exp.* Amongst other Mosses, Chiusenji and Mogisan, *Bisset.* It had before been collected by *Ito Keiske.*

In India this is found from the Nilgiri Mountains to Bhotan.

187. T. VIRIDE, sp. n. Caules arcuati, ramis decrescentibus ramulisque satis copiosis bipinnati, phyllidiis brevibus parum densis vestiti. Folia erecto-patentia a basi dilatata subreniformia, in subulam breviusculam angustata, inferne plicata, nervo in subulam vix producto, margine apicem versus minute serrulata, cellulis ovalibus dorso papilliferis areolata; ramea latissime ovata, ramulinaque ovata, excavata, acuta, cellulis rotundatis papillis brevibus areolata; cellula apicalis ramulinorum pluridenticulata.

Gathered by *Maries* and at Kintoki by *Bisset.*

Habitus omnino *Thuidii tamariscini,* statura autem minor, ramis ramulisque gracilioribus.

Different from *T. japonicum* in the short points of its cauline leaves, and also from *T. delicatulum.*

Great difficulty was always experienced in understanding the distinctions between *T. tamariscinum*, *T. delicatulum*, and *T. recognitum* until Lindberg pointed out the difference in the formation of the point of the apical cell of the ramuline leaves; that this is not understood in America, as is mentioned in the 'Manual of N. American Mosses,' of Lesquereux and James (1884), ceases to be surprising when all the supposed specimens from America tried by Lindberg's character are found to have their apical cells many-pointed, and are thus reduced to *T. delicatulum*, which may be the American representative of the European *T. tamariscinum.*

188. THUIDIUM CYMBIFOLIUM, Dozy et Molk. Bry. Jav. ii. t. 221, and also

189. T. TAMARISCINUM, Bruch et Schimp., are both recorded from Japan by Sande-Lacoste as gathered by *Ito Keiske* and *Siebold*, and Thunberg has

190. T. DELICATULUM, Bruch et Schimp., *Hypnum delicatulum*, Hedw., collected by Kæmpfer.

Sect. *Tetracladium.*

Caules continui, ramis tetrastichis.

191. T. MOLKENBOERII, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. ii. 298, t. 2. Jigoku-gawa, Nikko, *Bisset.*

The perfectly complete state of this species differs slightly from the splendid figure in having its lateral branches less flexuose; in all other particulars Mr. Bisset's specimens agree, and show this elegant Moss to have stems from six to nine inches long, with short lateral branches, so regularly placed as to give them a breadth of about half an inch throughout. The arrangement of the lateral branches in two planes on each side of the stem, so that they are in four ranks, is a character not obvious in dried and pressed specimens, but conspicuous when their natural position is restored by maceration. The same arrangement is found in the noble *T. Hookeri*, Mitt. (*Leskea Hookeri*, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 132); *T. Brandisii*, Jaeger (*Hypnum Brandisii*, C. Muell. in Rev. Bry. (1878), 63), a similar but rather smaller species; *T. Blandovii*, Mitt. (*Hypnum Blandovii*, Web. & Mohr); *T. decipiens*, De Not.; and *T. abietinum*, Bruch et Schimp. (*Hypnum abietinum*, Linn.). In all these, besides the difference in the disposition of the branches, there is the difference in habit, the stems being continued indefinitely without interruptions or becoming arcuate and stoloniform, as is so conspicuously the habit of *T. tamariscinum.*

There is to all appearance another species which has been overlooked or confused—T. QUADRIFARIUM, foliis caulinis illis *T. recogniti* similibus, nervo infra apicem evanescente, rameis latioribus, perichætialibus integerrimis. Collected in Canada by *Prof. Macoun.* Fertile stems were distributed by Wilson as American examples of the fruit of *Thuidium recognitum*; and his specimen, in his complete collection of British Mosses, consisted of a single barren stem, to represent that species, which appears also to be *T. quadrifarium.* Drummond, Musc. Amer. (1828), no. 214, has this as *Hypnum proliferum*, var. *compactum—H. delicatulum*, Hedw., being usually *T. Blandovii.* Funk, n. 436, has a single stem with a fruit added as *H. recognitum*, and barren specimens with the same name are in Schimper's 'Stirpes Normales': other barren specimens have been seen from the Vosges and the St.-Gothard pass; none, however, of these specimens are fully satisfactory, and the species, if it be truly so, wants further observation in a living state in Europe. The American specimens from Drummond are all very short, as if broken off merely to show the fruit; but the species should be recognized by its continuous stems, not stoloniform at their apices, and the branches in four rows, from *T. recognitum*, which has its branches in two rows only and is arcuate.

Sect. *Tamariscella*, C. Muell.

192. Thuidium cylindraceum, sp. n. Monoicum. Caulis pinnatus, paraphyllis brevibus. Folia caulina a basi hastato-cordata, concava, subulato-acuminata, subula elongata sæpe diffracta, nervo ante subulam desinente, integerrima, ramea patentia ovata subcompressa, dorso papillosa, nervo concolore infra apicem evanescente; perichætialia erecta, elongata, integra. Theca in pedunculo lævi elongato cylindracea, inclinata, fere æqualis subarcuatave; peristomio normali, ciliis singulis.

Fujisan, with old fruit in May, *Bisset.*

In stature and appearance this resembles *T. minutulum*, but has a differently-shaped capsule.

193. T. bipinnatulum, sp. n. Monoicum. Caulis bipinnatus, paraphyllis brevibus. Folia hastata acuminata, marginibus recurvis, nervo infra apicem evanido, ramea ovata ramulinaque obtusiora subcompressa patulo-incurva, dorso marginibusque papillis erosa; perichætialia apicibus subulatis recurvis. Theca in pedunculo elongato cylindracea, parum inæqualis, inclinata; peristomio normali, ciliis binis.

Chiusenji, *Bisset.*

To the unassisted eye, like the preceding, this is indistinguishable from *T. minutulum*; but there is the same difference in the form of the capsule, and the two Japanese species differ in ramification.

194. Hypnum assurgens, Sulliv. et Lesq. in Proc. Amer. Acad. iv. (1860) 279.

Found on decayed logs at Ousima, Loo Choo Islands, Amer. Explor. Exp., which is described as having stems without paraphylla, leaves linear-lanceolate from a cordate base, cells opaque, and the peduncle tuberculose, seems to belong to this group.

MNIODENDRON, Lindb.

195. M. Korthalsii, Van den Bosch et Sande-Lacoste, Bry. Jav. ii. t. 236.

One stem, gathered by *Siebold*, is mentioned in Miquel.

FISSIDENS, Hedw.

196. F. ADIANTOIDES, Hedw.—*F. decipiens*, De Not., et *F. cristatus*, Wils. ex Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 137.

Small barren stems, '*Challenger*' *Exp.*; fertile specimens, Oyama, *Bisset.*

197. F. JAPONICUS, Dozy et Molk.

'*Challenger*' *Exp.*; and at Nagasaki by *Oldham*, all barren. Fertile by *Maximowicz.*

Like *F. nobilis*, Griff., and *F. acutifolius*, Mitt., this species has its leaves with a limb more or less distinct and finely serrate.

Three other species (*F. laxus*, *F. incrassatus*, and *F. pungens*) are described by Sullivant and Lesquereux, p. 276, with characters insufficient for their recognition.

ATRICHUM, Beauv.

198. A. UNDULATUM, Beauv.

In a state scarcely different from common European specimens, one fertile stem and a few without fruit, '*Challenger*' *Exp.*; in a state with narrower leaves, and with the inflorescence variable—Jokyo, Chiusenji, Jigoku-gawa, Hakodate, Fujisan, Nikko, and Ikao, *Bisset.*

It is possible that this narrower-leaved state may prove distinct, although differences in other particulars have not yet been observed. A state in which the leaves on the lower portions of the stems are like those of *A. undulatum*, but with the comal leaves much narrower and more like those of *A. angustatum*, was collected in the United States by Torrey and Drummond.

199. A. ANGUSTATUM, Schimp., *Polytrichum angustatum*, Hook., is enumerated from Japan by *Sande-Lacoste* in Miq. Ann. Mus. Bot. Lugd. Bat. i. 295. It may be the narrow-leaved state of *A. undulatum.*

OLIGOTRICHUM, DC.

200. O. LESCUREI, Mitt.—*Atrichum Lescurei*, James in Bull. Torrey Club, vi. 33; Lesquereux et James, Manual, 257.

Nantaizan, Sept., *Bisset.*

A very distinct species with sharply-toothed leaves, which have, towards the base on each side, a few of the teeth produced into hairs. The capsule is, when empty, turbinate; the calyptra is small, smooth, and shining. It has no resemblance to any species of *Atrichum.*

POGONATUM, Brid.

Sect. *Anasmogonium.*

201. P. SPINULOSUM, Mitt. in Journ. Linn. Soc., Bot. viii. 156.

Nikko, *Bisset.*

202. P. ALOIDES, Brid.

With old fruit, '*Challenger*' *Exp.*; Joshin, Tokio, Hakone, &c., *Bisset*; and a state with the neck of the capsule gradually tapering into the seta—var. *longicolle*—at Ikao, Ubago, and Nikko, *Bisset.*

203. Pogonatum inflexum, Lindb. in Notiser Sällsk. Faun. et Flor. Fenn. ix. (1867), 100.

Described by Sande-Lacoste in the Ann. Mus. Bot. Lugd. Bat. iv. p. 308: Caule simplici sat elato, foliis angustis longis acutis, laminis margine incrassatis et dilatatis, capsula regulari erecta cylindrica (=*P. aloides*, Sande-Lacoste in Miquel, in Ann. Mus. Bot. Lugd. Bat. ii. p. 292).

204. P. japonicum, Sulliv. et Lesq. in Proc. Amer. Acad. iv. (1860), 278.

Ojigiki, with fruit nearly ripe in October, also at Ikao, Nantaizan, Fujisan, Shiranesan, and Chiusenji, *Bisset.*

Sect. *Eupogonatum.*

205. P. urnigerum, Brid.

Hakodate, *Bisset.*

Collected in Manchouria by *Wilford.*

206. P. himalayanum, Mitt. in Journ. Linn. Soc., Bot. iii. Suppl. 151.

Fujisan, *Bisset.*

The specimens are not quite conclusive. The species can generally be recognized by its perichætium appearing to be lateral.

207. P. grandifolium, Mitt.—*Polytrichum grandifolium,* Lindb. in Act. Soc. Sci. Fenn. x. (1872) p. 264.

Nantaizan, Ikao, Chiusenji, Yumoto, *Bisset.*

Specimens of *P. alpinum*, Brid., collected by Douglas in N.W. America, have longer and more spreading leaves, approaching the preceding; but they seem to be connected with the usual states by intermediate forms.

POLYTRICHUM, Dill.

208. P. gracile, Menz.

With capsules nearly perfected, '*Challenger*' *Exp.*; Fujisan, *Bisset.*

209. P. juniperinum, Hedw.

Hakodate, the lakes, *Bisset.*

210. P. piliferum, Schreb.

Fujisan, *Bisset.*

211. P. commune, Linn.

Mitake, alt. 6000 feet, *Bisset.*

Lindberg mentions a var. *Maximoviczii*, with dense foliation, of which the male plants only were collected at Nambu, ins. Nippon.

DIPHYSCIUM, Mohr.

212. D. FULVIFOLIUM, sp. n. Caulis brevissimus. Folia inferiora spathulato-ligulata, apice obtusa, mucrone brevissimo, dimidio inferiore pallido, elongate areolato, subpellucido, superiore cellulis densis obscuro, margine apicem versus minute crenulata, nervo lato concolore percursa; superiora patentia duplo longiora, basi pallidiore breviore, nervo crassiore, in mucronem plus minus elongatum excurrente; perichætialia plurima a basi brevi lanceolato-subulata integra, nervo crasso ubique scaberrimo fulvo sensim attenuato excurrente. Theca parva, leptodermis; peristomio pallido inferno carinis pluribus plicæformibus.

'Challenger' Exp.

Habit and size that of *D. foliosum*; but with longer perichætial leaves, and those of the stem have not so dense an areolation.

TETRAPHIS, Hedw.

213. T. GENICULATA, Girgens.

A few stems on decayed wood, '*Challenger*' *Exp.*

ANDREÆA, Ehrh.

214. A. PETROPHILA, Ehrh.?

One or two stems amongst *Grimmia*, Nantaizan, *Bisset.*

SPHAGNUM, Dill.

215. S. GIRGENSOHNII, Russ.

Shiranesan, *Bisset.*

216. S. CYMBIFOLIUM, Ehrh., was gathered by *Siebold.*

HEPATICÆ.

PLAGIOCHILA, Nees et Mont.

1. P. OVALIFOLIA, sp. n. Caulis ascendens arcuatus, ramis etiam arcuatis divisus. Folia distiche explanata patenti-divergentia, late ovalia, inferne dorso convexa, margine dorsali breviter decurrente e medio ad apicem rotundatum, margineque ventrali ad basin usque dentibus brevibus acutis approximatis armata, e cellulis parvis rotundatis limitibus angustioribus cinctis areolata; involucralia conformia, dentibus apicalibus ventralibusque majoribus. Perianthium oblongo-obovatum, labiis rotundatis dentatis.

Fragments gathered amongst Mosses by *Maingay*; *Maries*; and at Nikko by *Bisset.*

Caulis 1–2-uncialis, cum foliis ubi latius expansis 7 mm. latus. Folia 3 mm. longiora, 2 mm. lata. Perianthium foliis involucralibus æquilongis compressum, labiis versus medium eorum longitudinis in angulum obtusum ascendentibus, inde ad latus ventrale profundius fissum descendentibus.

All the fragments of this, until the perianth had been found, were supposed to belong to *P. asplenioides*; but the perianth shows it to be different; instead of a truncate mouth its mouth is oblique, and more deeply cleft on the ventral side.

2. Plagiochila trapezoidea, Lindenb. Sp. Hep. 112, t. 22, and

3. P. blepharophora, Lindenb. Sp. Hep. 102, t. 21, are enumerated in Miquel's 'Prolusio' by Sande-Lacoste. The first of these in foliage is near the preceding species, but has a perianth nearly as in *P. asplenioides*; the second has its leaves with ciliiform teeth.

4. P. furcifolia, sp. n. Caulis gracilis dichotomus viridis. Folia patentia ovato-oblonga, sinu acuto plus minus profundo, laciniis lanceolatis acutis furcata, margine dorsali recta recurva, ventrali uni- bidentato, e cellulis grossiusculis rotundis areolata, mollia, fragillima.

On dead bark, '*Challenger*' *Exp.*

Caulis 2 cm. altus, cum foliis completis 3 mm. latus. Folia sordide viridia, fere omnia ubique cruribus diffractis incompleta.

Not unlike small specimens of *P. punctata*, Tayl., when the apices of the leaves are all broken off, as is generally the case, so that an entire leaf is found with difficulty, the two crura being snapped off at their bases.

5. P. japonica, Sande-Lacoste in Ann. Mus. Bot. Lugd. Bat. i. 290 (1864).

'*Challenger*' *Exp.*

Compared by the author to *P. spinulosa*, from which there can be little doubt the 'Challenger' specimens are correctly referred. No perianths have been seen; but the whole appearance is so similar to that of *P. orientalis*, Tayl., that it may prove identical.

Probably no species of the great genus *Plagiochila* has fared worse in the hands of describers and delineators than the British *P. spinulosa*. Dillenius described it, 'Hist. Musc.' 489, and figures it t. 70. f. 15, with unusually branched stems, which he collected on Snowdon. To this Dickson, fasc. ii. 14, affixed the name *Jungermannia spinulosa*: "frondibus erectis ramosis, foliis obovatis dentato-spinosis. Hab. in Alpibus Scoticis," is all he says about it. In Hooker's 'Brit. Jung.' the figure of the stem is life-like; and the ala on the perianth, which is imperfect, is obvious, although not mentioned in the description of figs. 5 and 6. The leaves are described as they appear when looked at *in situ*, obovate; when, however, they are removed from the stem their true form is ovate-deltoid: the perianths described as lateral and axillary are found in that position, left so by innovations; at first they are terminal. Lindenberg (Sp. Hep. 6, t. 1) follows Hooker in saying the leaves are obovate, and he did not see the ala. In Lindenb. & Nees' Synopsis Hepat. p. 25, the leaves are "obovato-cuneiformibus semicordatisque."

The perianth, when more fully grown, is for half its length exserted above the involucral leaves, obconic, the mouth with rounded lips, the ala dentate in its upper part, reaching from the mouth to the base. Male plant and capsules alike unknown.

From this species Taylor separated his *P. punctata*, on account of its denser areolation; and the leaves, described in the Synops. Hepat. 626 as "obovato-cuneatis subrotundisve," are, when removed from the stem and spread out, ovate, with the apical teeth usually distinctly two and much more evident; the areolation consists of cells with thicker walls and usually a few oblong in form in the middle of the base; the perianth is obovate, the mouth truncate dentate as in *P. spinulosa*, but with no ala. It is capsuliferous in Madeira; specimens from the Canaries were marked by Taylor *P. diacantha*, but are not known to have been described. This is the species well figured by Stephani as *P. spinulosa*, 'Deutschland's Jungermannien,' p. 18, fig. 14. Neither *P. spinulosa* nor *P. punctata* have been seen amongst the Mosses collected in British N. America, and the *P. tridenticulata*, Tayl., if represented by Sullivant's specimen *P. spinulosa*, Musc. Allegh. No. 219, is a species not found as yet in Britain.

Amongst the numerous specimens of Hepaticæ sent by Miss Hutchins from the neighbourhood of Bantry, in Ireland, was one paper marked "39"; the paper and writing are the same as that containing the specimens of *P. spinulosa* similar to the figure in the 'Brit. Jung.'; it contained a mass as large as the hand, consisting of *Hymenophyllum*, matted together with *Plagiochila spinulosa*, *P. punctata*, *Bazzania denudata*, and *Adelocolea decipiens*, intermixed with scattered stems of another *Plagiochila*, with stems about an inch tall, arising from a creeping or procumbent rhizome; they have a few stoloniform divaricate shoots. The leaves are larger towards the perianth, and patulous or divergent, oval or ovato-oval in outline, with apex rounded, and on the apex, as well as the ventral margin, with many short broad teeth; the recurved entire dorsal margin is shortly decurrent; involucral leaves a little more dentate; perianth obovate, bent over to the ventral side, without ala, its lips rounded, shortly dentate. No trace of this can be found amongst the abundant specimens of all the other species which Miss Hutchins collected; but it seems to be not different from the *P. ambigua*, Mitt. in Journ. Linn. Soc., Bot. v. 96, a name found to have been already more than once used for different species, and therefore may be changed for that of P. AMBAGIOSA. It was not Miss Hutchins's habit to mark localities, and her papers are with and without names of the species enclosed. That a N. Indian species should be found in S. Ireland need excite no surprise when the Irish *Mastigophora Woodsii* and *Martinellia planifolia* grow in India mixed with *Jungermannia orcadensis* bearing perianths.

P. ambagiosa may easily be overlooked for a small state of *P. asplenioides*; but it is not really more closely allied to that than it is to *P. spinulosa*.

MARTINELLIA, S. F. Gray.

6. M. IRRIGUA, Mitt.—*Scapania irrigua*, Nees.

A few stems among Moss, '*Challenger*' *Exp.*

It is mentioned from Sachalin by Lindberg.

7. M. GRACILIS, Lindb.—*Scapania ciliata*, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. i. 298 (1867); *S. Bolanderi*, Austin in Proc. Acad. Nat. Sci. Philad., Dec. 1869.

Intermixed with *Cladonia*, Shiranesan, Nantaizan, *Bisset*.

This widely distributed species, so long mistaken for a variety of *M. nemorosa*, for which Sande-Lacoste himself says he at first overlooked it, certainly differs both in the outline and substance of its leaves.

8. Martinellia javanica, Mitt.—*Scapania javanica*, Gottsche in Nat. Tijdschr. Nederl. Indie, Nieuwe Serie, i. (1853) 575.

This is in Miq. Ann. Mus. Bot. Lugd.-Bat. i. 298, as from Japan. It is a small brownish species.

Another distinct species is:—

M. microdonta, sp. n. Caulis crassiusculus simplex. Folia complanata, lobis minute spinuloso-denticulatis, basi cordatis, auriculis trans caulem productis eique appressis, angustis, haud decurrentibus; lobo ventrali ovali, apice rotundato rarius angulo parvo terminato, lobo dorsali concavo quadruplo minore, apice angulo subrecto acuto incurvo, ambitu subreniformi.

Hab. Plover Bay, a locality in the N. Pacific, brought thence by a seaman who picked a few Mosses in Kamtschatka and in Vancouver.

Caulis 3 cm. altus, cum foliis 3 mm. latus. Folia lobo ventrali 2 mm. longo, medio 1 mm. lato, dorsali 1 mm. longo, denticulis remotiusculis e cellula unica acuta conditis ciliata.

DIPLOPHYLLUM, Dum.

9. D. albicans, Dum.

Small stems amongst *Lepidozia setacea*, '*Challenger*' *Exp.*; amongst Mosses, Nantaizan, *Bisset.*

These fragments all belong to the form "*taxifolium.*" Lindberg had this from Sachalin, and describes another species, *D. plicatum*, also from thence, which, from his description, must be nearer to *D. Dicksoni*, which last is found in N.W. America.

JUNGERMANNIA, Linn.

10. J. minuta, Dicks.

A few fragments amongst *Cladonia, Bisset.*

PLECTOCOLEA, Mitt.

(*Solenostomæ* subgen., Mitt. in Journ. Linn. Soc., Bot. viii. 156.)

11. P. radicellosa, Mitt.—*Solenostoma radicellosa*, Mitt. in Journ. Linn. Soc., Bot. viii. 156.

Nagasaki, *Oldham*; fragments with Mosses, *Bisset.*

12. P. infusca, sp. n. Caulis procumbens, stolonibus ventralibus descendentibus, radicellis pallidis. Folia rotundo-ovata obtusa, margine dorsali inferne incurva, laxe patula, imbricata, caulem dorso tegentia. Perianthium ovatum ore parvo denticulato, fructu egresso plurilaciniato, paulo infra medium cum foliis duobus superioribus adnatum, teres, exinde ad apicem plicis tribus majoribus interjectis nonnullis humilioribus exaratum.

'*Challenger*' *Exp.*

Caulis cum foliis expansis 3 mm. latus. Folia olivaceo-viridia, e cellulis parvis rotundatis, plerumque inanibus, areolata, fere 2 mm. longa, 1 mm. lata. Perianthium 2 mm. longum, apice supra folia involucralia parum exserto.

This differs from the preceding in the more ovate rotund form of the leaves, which are so disposed on the dorsal side that the stem is not visible between them, and the radicles so abundant in that species are in the present inconspicuous.

13. Plectocolea virgata, sp. n. Caulis a rhizomate repente assurgens erectus. Folia inter se remotiuscula rotundata patulo-expansa convexave, involucralia duo inferne cum perianthio ovato triplicato, ore parvo denticulato, demum laciniato, usque ad tertiam partem ejus longitudinis coadunata.

'*Challenger*' *Exp.*

Caules satis crassi, pallidi, cum foliis expansis 1·50 mm. lati, radicellis pallidis purpureisque paucis. Folia 1 mm. breviora, e cellulis rotundis hexagonisque inanibus, parietibus angustis areolata, pallida. Perianthium 1·50 mm. longum, basi purpureo tinctum.

Much less in all its parts than *P. infusca*, and with the foliage so arranged that the stem is everywhere visible. Its habit appears different from the fertile stems being erect, accompanied by others arcuate and sterile.

14. P. Sieboldii, Mitt.—*Jungermannia Sieboldii*, Sande-Lacoste in Ann. Mus. Bot. Lugd. Bat. i. 288, t. 8 (1864).

Hakone Pass, *Bisset.*

This differs from both the preceding species in having a conspicuous stipule; it is described and figured with the involucral leaves notched; this is not observable in our specimens; but the apices of the involucral leaves are so flexuose-sinuate as to produce the appearance of their being bilobate.

15. P. polyrhiza, Mitt.—*Jungermannia polyrhiza*, Hook.

Recorded by Sande-Lacoste in Miquel; and a barren specimen collected by *Maingay* may belong to it.

When *Solenostoma* and *Plectocolea* were used in the 'Journal of the Linnean Society' (Botany), viii. p. 156, neither Gray's nor Dumortier's genera had been resuscitated, nor had the distinctions between these two different groups of species been sufficiently considered. *Solenostoma* was intended to include all those which correspond in perianth with the *Jungermannia sphærocarpa* and other similar species in which the mouth is contracted into a tubular orifice similar to that of the *Frullaniæ* and *Lejeuniæ*, and which only is rendered dentate by the bursting through of the capsule at its egress. In *Plectocolea* the apex of the perianth is not contracted into a tube, but is more or less evidently dentate, not different from that usually ascribed to *Jungermannia.* All the Japanese species are so evidently congeneric with the original species (*P. radicellosa*) that they have been here kept together, and their position in the group to which they belong, when seen from a point of view different from that commonly accepted, can be best shown by arranging some of the best known species in a descending series, thus :—

* Perianth free (=*Eujungermannia*, Spruce).

cordifolia (*Jungermannia cordifolia,* Hook.).
riparia (*Jungermannia riparia,* Tayl.).
Ariadne (*Jungermannia Ariadne,* Tayl.).
fossombronioides (*Jungermannia fossombronioides,* Austin).
Sieboldii (*Jungermannia Sieboldii,* Sande-Lacoste).

** Perianth with one or both involucral leaves adherent.

Junghuhniana (*Jungermannia Junghuhniana,* Nees).
polyrhiza (*Jungermannia polyrhiza,* Hook.).
hyalina (*Jungermannia=Nardia Eucalyx,* Lindb.).
obovata (*Jungermannia obovata,* Nees).
virgata, Mitt.
infusca, Mitt.
radicellosa, Mitt.
crenuliformis, Austin.

*** Perianth with more than one pair of leaves coadunate.

Hasskarliana (*Alicularia=Nardia Eucalyx,* Lindb.).
scalaris (*Nardia,* S. F. Gray; *Alicularia,* Corda).
compressa (*Jungermannia=Nardia,* S. F. Gray=*Mesophylla,* Dum.).

In the *Jungermanniæ* the greatly preponderating condition of the perianth is to be free from the involucral leaves, and it is here assumed to be the normal state, and the adhesion of one leaf in *P. hyalina* and of two in many other species are departures leading directly to the condition observable in *P. scalaris.* In all the species above mentioned the form and structure of the perianth or colesule is the same, and little different from that ascribed to *Jungermannia,* its altered appearance in *P. compressa* and *P. scalaris* being due to the adhesions of the subtending leaves.

The species referable to *Solenostoma* and *Plectocolea* are all destitute of the incised involucral leaves which characterize those included in *Jamesoniella* and *Syzygiella,* Spruce, and in this particular agree with *Liochlæna* and *Mylia.*

LOPHOCOLEA, Dum.

16. L. compacta, sp. n. (Plate LI. figs. 21–23.) Caulis prostratus, repens. Folia explanata rotunda rotundo-ovatave, apice obtusissima, integerrima, retusa vel oblique truncata breviterque bidentata, e cellulis rotundatis limitibus obscurioribus areolata. Amphigastria basi libera, caule parum latiora, ovato-quadrata, bifida, utrinque unidentata. Folia involucralia conformia, amphigastrio parvo. Perianthium oblongum prismaticum, angulo dorsali superne alato, labiis rectangulatis dentatis.

Creeping on bark amongst *Stereodon circinalis, 'Challenger' Exp.*

Caulis crassiusculus uncia brevior, cum foliis explanatis 2 mm. latus. Folia olivaceo-viridia obscura.

Allied to the Australian *L. heterophylloides,* but smaller; no truly bidentate leaves have been seen, and it is inodorous.

CHILOSCYPHUS, Corda.

17. C. ARGUTUS, Nees.
With perianths, '*Challenger*' *Exp.*

18. C. PLANUS, Mitt. in Journ. Linn. Soc., Bot. viii. 157.
Nagasaki, *Oldham*; '*Challenger*' *Exp.*
Fragment with Moss, *Bisset.*

19. C. COALITUS, Nees.—*Jungermannia coalita*, Hook.
Barren stems in a poor state, '*Challenger*' *Exp.*

Similar states occur in India; and it may be uncertain whether they belong here or to some *Lophocolea.*

20. C. POLYANTHUS, Corda.—*Jungermannia polyanthus*, Linn.
Barren specimens, '*Challenger*' *Exp.*

It is enumerated by Sande-Lacoste as *C. pallescens*, and is a species mentioned by Thunberg.

ODONTOSCHISMA, Dum.

21. O. DENUDATUM, Dum.

In extensive patches barren, '*Challenger*' *Exp.*; also fragments amongst Moss, Nantaizan, *Bisset.*

CEPHALOZIA, Dum.

22. C. CATENULATA.—*Jungermannia catenulata*, Hübner.
A few stems amongst *Lophocolea compacta*, '*Challenger*' *Exp.*

23. C. DENTATA.—*Jungermannia dentata*, Raddi.
Nagasaki, *Oldham.*

24. C. DIVARICATA.—*Jungermannia divaricata*, Sm. Eng. Bot.
Recorded in Miquel's 'Prolusio.'

LEPIDOZIA, Nees, Lindenb. et Gottsch.

25. L. SETACEA.—*Jungermannia setacea*, Web.
'*Challenger*' *Exp.*

26. L. REPTANS.—*Jungermannia reptans*, Linn.
This is in Sande-Lacoste's enumeration.

27. L. FILAMENTOSA, Lehm. & Lindenb.
Nantaizan, *Bisset.*
The specimens agree with N.W. American. It is a larger species than the preceding.

BAZZANIA, S. F. Gray.

28. B. JAPONICA.—*Mastigobryum japonicum*, Sande-Lacoste in Ann. Mus. Bot. Lugd. Bat. i. 303, t. 8.

'*Challenger*' *Exp.*; also by *Maingay*; and frequently amongst Mosses, *Bisset*; Nagasaki, *Maximowicz.*

29. Bazzania Pompeana.—*Mastigobryum Pompeanum*, Sande-Lacoste in Ann. Mus. Bot. Lugd. Bat. i. 304, t. 8.

'*Challenger*' *Exp.*; Shinano, *Bisset.*

Much like the European *B. trilobata.*

30. B. tridens.—*Mastigobryum tridens*, Nees.

This is included in the list of Japanese species given in Miquel's Ann. Mus. Bot. Lugd. Bat. i. 303.

KANTIA, S. F. Gray.

31. K. bidentula, S. F. Gray.

Chiusenji, *Bisset.*

BLEPHAROSTOMA, Dum.

32. B. trichophylla.—*Jungermannia trichophylla*, Linn.

Amongst Mosses, '*Challenger*' *Exp.* and *Bisset.*

BLEPHAROZIA, Dum.

33. B. sacculata, sp. n. Caulis crassiusculus, ramis approximatis brevibus patentibus in frondem plumæformem dispositis, pinnatus. Folia dorso imbricata, ambitu subcordato-ovata, inæqualiter bifida, lobo dorsali majore basi subcordata, apice acuto, sinu rotundato, in lobo ventrali minore basi in sacculum involutum parvum subovalem transeunte, marginibus ubique ciliis angustis æquidistantibus elongatis fimbriatis, cellulis rotundo-hexagonis limpidis areolata. Amphigastrium basi brevi, in laciniis brevibus irregularibus longe ciliatis 3–4 divisum.

Creeping in an upright manner on the stems of *Dicranum scoparium*, Chiusenji, *Bisset.*

Caulis 2 cm. altus, cum ramis 6 mm. latus, pallidus carnosulus, cum foliis 2 mm. latus. Folia dorso imbricata lævia, ventre apicibus loborum ad caulem incurva. Sacculum iis *Lejeuniarum* simillimum, a caule divergens.

In external appearance this has a close similarity to small states of *B. ciliaris* which are sometimes found on trees; the areolation and the cilia are similar; but instead of the leaf being cleft into four or five lobes, it is divided only into two, and the presence of a sac, similar to that of the *Lejeuniæ*, is a character unexpected in a genus of which *B. ciliaris* is the type.

TRICHOCOLEA, Nees.

34. T. tomentella, Nees.—*Jungermannia tomentella*, Ehrh.

Gathered by *Maries.*

MASTIGOPHORA, Nees.

35. M. Bisseti, sp. n. Caulis bi- tripinnatim ramosus plumæformis. Folia parva inter se discreta cauli appressa, ad medium quadrifida, laciniis acutis, dorsali majore, margine ubique ciliis triarticulatis angustis fimbriata, e cellulis parvis rotundatis

areolata. Amphigastria ambitu subovata, caule angustiora, fere ad basin fissa laciniis lanceolatis, marginibus recurvulis ciliatis ad angulos exteriores ciliis subcalcariformibus. Folia ramulina ulteriora basi angusta substipitata, inde trifida laciniis angustis incurvis, e cellulis oblongis limpidis areolata, margine basi nuda, inde ut caulina ciliata; altera autem inter alias obvia lacinia, tertia ventrali in lobulum obovatum divergentem, sacculiformem, tumidum, inflatum, orificio parvo angusto intus aperto transformata: ramulina bifida, ceteroquin foliis similia.

Fujisan, *Bisset.*

In size, colour, ramification, and appearance this so closely resembles *Trichocolea tomentella* as to be easily passed over as the common state of that widely distributed species. The presence of an inflated lobule, as in *Polyotus* and *Frullania*, on the leaves of a species of *Mastigophora* is as much an unexpected condition as that of the sac in *Blepharozia*. The areolation of the ramuline leaves, so different from that of the cauline, agrees with that of the leaves of *Trichocolea*; but when the inflated lobule is formed it is found to be composed of rounded cells. The inflated lobules, like those of *Polyotus*, may perform the same office to the species in which they are found as do those of *Utricularia*.

RADULA, Dum.

36. R. JAPONICA, Gottsche ex Stephani in 'Hedwigia' (1884), p. 152.—*R. physoloba*, Mitt. in Journ. Linn. Soc., Bot. viii. 157.

Nagasaki, on rocks, barren, *Oldham.*

This is a dioicous species, growing in a prostrate manner, of a brown colour.

37. R. OYAMENSIS, Stephani in 'Hedwigia' (1884), p. 152.

Barren stems among Moss, *Maingay.*

This is described as dioicous. Better specimens may show this to be pinnate.

38. R. TOKIENSIS, Stephani in 'Hedwigia' (1884), p. 150.

Fragments on a *Collema*, '*Challenger*' *Exp.*, and on Mosses, *Bisset.*

Inflorescence described as paroicous; antheridia are in some of the involucral leaves, also in smaller-leaved branches.

R. complanata is mentioned in Sande-Lacoste's list; but it is probably one of the above, which at that time had not been distinguished.

PORELLA, Dill.

39. P. CILIARIS, Mitt.—*Madotheca ciliaris*, Nees.

Barren stems, '*Challenger*' *Exp.*

40. P. VERNICOSA, Lindb. in Act. Soc. Sci. Fenn. x. (1872) 223.

On a rock near Nagasaki, 1863, *Maximowicz.*

Described as an indistinctly pinnate species, "rigida, vernicoso-nitida," the rounded obtuse leaves "grosse ciliatis."

41. Porella polita, sp. n. Gracilis, pinnatim ramosus. Folia lobo dorsali imbricata, lævissima, nitida, divaricata, semicordato-oblonga, apice rotundato inflexo denticulato, lobo ventrali parvo erecto-patente ovato, apice rotundato crenato denticulato, basi dentibus paucis spinosis. Amphigastria orbiculari-ovata, apice repanda, medio excavata, marginibus crenatis, basi spinoso-dentata.

Hakone Pass, amongst Mosses, *Bisset.*

In size and colour this corresponds with *P. lævigata*; but the form of the leaf is more rounded at the apex, without the tendency to become acute; barren fragments only have been seen.

42. P. gracillima, sp. n. Caulis pinnatus. Folia lobo dorsali imbricata oblata, apice incurva integerrima, lobo ventrali parvo erecto-patente ovato oblongo obtuso, basi interno externoque uni- bidentato. Amphigastria ovata, apice ligulata recurva, basin versus in umbonem parvum excavata, basi utroque angulo unidentata.

Nantaizan, fragments with Moss, *Bisset.*

Statura *Frullaniæ tamarisci* similis. Color sordide viridis. Folia subnitida.

In size this is only comparable to *P. chilensis.*

43. P. japonica, Mitt.—*Madotheca japonica*, Sande-Lacoste, Syn. Hep. Jav. 105, t. xxi.

Mixed with *Frullania tamarisci* and other Hepaticæ, *Herb. Dozy* et *Molkenboer.*

It appears to be a small species, in which the stems are not distinctly pinnate and the leaves not incurved to the ventral side.

44. P. platyphylla, Lindb.—*Jungermannia platyphylla*, Linn.

Fragments of a dark opaque green, '*Challenger*' *Exp.*, appear to belong here.

FRULLANIA, Raddi.

45. F. dilatata, Nees.—*Jungermannia dilatata*, Linn.

Fragments with a lichen, *Bisset.*

46. F. æolotis, Nees.

Enumerated by Sande-Lacoste. It is found in China.

47. F. japonica, Sande-Lacoste in Ann. Mus. Bot. Lugd. Bat. i. 311.

Japan, *Siebold*; creeping over *Dendropogon dentatus*, Nikko, *Dr. Woods*; Kintoki, *Bisset.*

In general appearance not unlike *F. Tamarisci*, but distinguished immediately by its entire stipules of an oblate form; the perianth has not yet been found; but the involucral leaves have lanceolate entire lobes.

48. F. Tamarisci, Nees.—*Jungermannia Tamarisci*, Linn.

'*Challenger*' *Exp.*; Nikko, *Bisset*; gathered also by *Maingay.*

The specimens agree with the state usually found in Europe on trees.

49. Frullania Hutchinsiæ, Nees.—*Jungermannia Hutchinsiæ*, Hook.

Is included by Sande-Lacoste in Miquel, Ann. Mus. Bot. Lugd. Bat. i. 312.

Several other species are found in China, one of which, in a barren state, is not distinguishable from *F. gracilis*; another is F. clavellata, sp. n. Caulis gracilis, pinnatus. Folia orbiculata, apicibus incurvis integerrimis, linea angusta cellularum moniliforme ultra medium producta, lobulo a caule remoto patente oblongo-clavato, basi lacinula angusta appressa. Amphigastria suborbiculata ovata obovatave, sinu parvo rectangulo bifida. Hong Kong, *Bowring*. Rami cum foliis 1 mm. lati, castanei. In size like *F. fragilifolia*, but more nearly related to *F. gracilis*.—Also F. tenuicaulis, sp. n. Caulis gracilis elongatus, pinnatim ramosus. Folia caulina alterna ovata, basi dorsali cordato-ampliata, apice acuta concava, basi ad angulum ventralem cellulis pluribus magnis rotundis rubris, reliquis parvis ovalibus, interstitiis latiusculis, lobulo parvo evoluto lanceolato clavatove cauli approximato. Amphigastria ovali-oblonga, medio carinata, marginibus recurvis, vix ad medium sinu acuto in lacinias latas acutas fissa. Involucra in apicibus ramorum, dein innovatione lateralia, foliis dentibus brevibus latis serratis. Manshan Mts. near Ookaisa, alt. 2400 feet. Quantung, Prov. S. China. Caulis 6 cm. longus, pendulus? ramis 5 mm. longis. Folia 1 mm. longa. This approaches the Javan *F. vaginata* and *F. ternatensis*.

LEJEUNIA, Lib.

50. L. minuta, sp. n. (Plate LI. figs. 24, 25.) Monoica. Pusilla. Caulis repens, ramosus. Folia lateraliter patentia, a matrice ascendentia, curvata, subovato-oblonga, apice subacuta obtusave, lobulo ovali, apice bidentulo appresso; involucralia conformia, e cellulis satis magnis ovali-hexagonis limpidis areolata, integerrima, lævia. Perianthium obovatum, obtusum, subplicatum.

On a fragment of *Peltigera*, '*Challenger*' *Exp.*; with *Dendropogon dentatus*, Nikko, *Dr. Woods*, *Bisset*.

Caulis radicellis pellucidis affixus. Folia 1 mm. longa, magnitudine variabilia, longiora breviora intermixta, sæpe arcuata. Perianthium 1 mm. longum. Antheridia satis magna, in ramis propriis foliis laxis ovatis acutiusculis. Amphigastria nulla.

This belongs to Spruce's *Cololejeunia*, and is too small to be understood without being considerably magnified.

51. L. japonica, sp. n. Monoica. Prostrata. Parum ramosa. Folia in caulis medio divergentia orbiculari-ovata, apice rotundata obtusave, ulteriora magis patentia, evidentius angulata, basi lobulo parvo tumido subovato, cellulis parvis rotundis areolata. Amphigastria caule duplo latiora orbiculata, fere ad medium sinu rectangulo fissa segmentis latis acutis. Perianthium in ramulo brevissimo subacaule obovatum, superne plicatum foliis involucralibus minutis inconspicuis.

Creeping on Moss, '*Challenger*' *Exp.*; Hakone Pass, *Bisset*.

In size this is similar to *L. serpyllifolia*, but in colour of a dull greyish green. The perianths are only exserted beyond the cauline leaves by about half their length.

52. LEJEUNIA SERPYLLIFOLIA, Lib., from Nagasaki, *Oldham*, and

53. L. ADPLANATA, Nees, are mentioned in Miquel, and fragments of several other species are amongst Mosses collected by *Bisset*.

PHRAGMICOMA, Dum.

54. P. POLYGONA, sp. n. Caulis repens, infra perianthium innovans. Folia dense imbricata, suborbicularia, integerrima, lobo ventrali subtrapezoideo angulo apicali lato obtuso integerrimo, e cellulis satis magnis areolata. Amphigastria orbicularia integerrima. Folia involucralia amphigastrioque orbiculari majora conformia. Perianthium immersum, oblongum, subcompressum, 12-plicatum.

Creeping closely on bark.

'*Challenger*' *Exp.* Found also in China.

Caulis cum foliis 1 mm. latus. Folia luteo-viridia obscura nigrescentia, sicca ad latus ventrale incurva. Perianthium 1 mm. longum, angulis lævibus.

55. P. FERTILIS, Nees.

Enumerated by Sande-Lacoste.

SCALIA, S. F. Gray.

56. S. ROTUNDIFOLIA, sp. n. Folia trifaria patentia, orbiculata, integerrima; involucralia erectiora, concava, sinuato-flexuosa. Calyptra elongata clavata.

A few stems intermixed with Mosses, '*Challenger*' *Exp.*

Caulis erectus, pallidus carnosus, 2 cm. altus. Folia viridia, inferiora remota parva, superiora congesta rosulata, 2 mm. lata. Calyptra 8 mm. longa, lutea. Pedunculus 3 cm. longus. Capsula fusca, 3 mm. longa.

Much larger than *S. Hookeri*, but entirely of the same habit and appearance, although the leaves are of a different form.

Another species of this interesting genus is found in Java—S. CARNOSULA. Caulis incrassatus pallidus. Folia trifaria, lateralia orbicularia patula, ventralia orbiculari-obovata, omnia inferne cellulis hexagonis amplis, superne versus margines duplo-minoribus carnosulis areolata. *Hab.* in Monte Salak ad ligna putrida. This in size is like *S. rotundifolia*, but appears to be more fleshy, and revives with difficulty.

RHOPALANTHUS, Lindb.

57. R. MNOIDES, Lindb.

A Japanese species described in 'Hedwigia,' 1875, p. 139, from the male plant only; it is evidently very closely allied to *Scalia*, and may prove to be the male of a species belonging to that genus; in colour it is described as "albido-pallida et hyalina."

METZGERIA, Raddi.

58. M. HAMATA, Lindb.—*M. ciliata*, Raddi in Herb. Hooker.

Fujisan, amongst Moss, *Bisset*.

59. M. FURCATA, Nees.—*Jungermannia furcata*, Linn.

Recorded by Sande-Lacoste.

PALLAVICINIA, S. F. Gray.

60. P. LYELLII, Mitt.—*Jungermannia Lyellii*, Hook.
Mentioned in Miquel, Ann. Mus. Bot. Lugd. Bat. i. 314.

ANEURA, Dum.

61. A. PALMATA, Dum.—*Jungermannia palmata*, Hedw.
Intermixed with *Odontoschisma denudatum*, '*Challenger*' *Exp.*

PELLIA, Raddi.

62. P. EPIPHYLLA, Nees.—*Jungermannia epiphylla*, Linn.
Fragments, '*Challenger*' *Exp.*

63. P. CALYCINA, Nees.—*Jungermannia calycina*, Tayl.
This is recorded in Miquel, and specimens appearing to be it were gathered at Nagasaki by *Oldham.*

SAUTERIA, Nees.

64. S. CRASSIPES, Austin in Proc. Amer. Acad. Sci. Philad. (1869) 229.
Japan, *American Explor. Exp.*

DUVALIA, Nees.

65. D. ? INTERMEDIA, Austin in Proc. Amer. Acad. Sci. Philad. (1869) 229.
From dry hill-sides, probably from Japan; but locality not stated.

CONOCEPHALUS, Hill.

66. C. CONICUS, Dum.—*Marchantia conica*, Linn.
Without fruit, '*Challenger*' *Exp.*; Nagasaki, *Maximowicz.*

ASTERELLA, Beauv.

67. A. HEMISPHÆRICA, Beauv.—*Marchantia hemisphærica*, Linn.
Nagasaki, *Oldham.*

68. A. LONGIPES, Mitt.—*Reboulia longipes*, Sande-Lacoste in Miq. Ann. Mus. Bot. Lugd. Bat. iii. 209.
Both enumerated in Miquel.

MARCHANTIA, Linn.

69. M. POLYMORPHA, Linn.;

70. M. DIPTERA, Mont. et Nees; and

71. M. GEMINATA, Nees—*M. chenopoda*, Thunberg, are all mentioned by Sande-Lacoste.

72. M. NITIDA, Lindenb. et Lehm.
Nagasaki, *Oldham.*

CYATHODIUM, Kunze.

73. C. JAPONICUM, Lindb.—*Lichen japonicum*, Thunb. Fl. Japon. 344; *Marchantia japonica*, Thunb. in Weber, Prodr. 107, *fide* Lindberg.

Gathered in fruit by *Siebold.*

It is not improbable that this may be the same species found in India and described and figured by Griffith as *Synhymenium aureo-nitens*; for Mr. C. H. Wright, of the Herbarium, Royal Gardens, Kew, has shown me a specimen from Formosa which is undistinguishable, and it may even prove to be the *Riccia spuria* of Dickson.

RICCIA, Mich.

74. R. NATANS, Linn.

Nagasaki, *Maximowicz.*

EXPLANATION OF PLATE LI.

Figs. 1–5. AULACOMITRIUM HUMILLIMUM.
- 1. Plant, natural size.
- 2. do. apex of stem, enlarged.
- 3. Leaf, enlarged. 3 *a*, cross section of same; 3 *b*, 3 *c*, cells, further magnified.
- 4. Calyptra enclosing fruit.
- 5. Empty capsule.

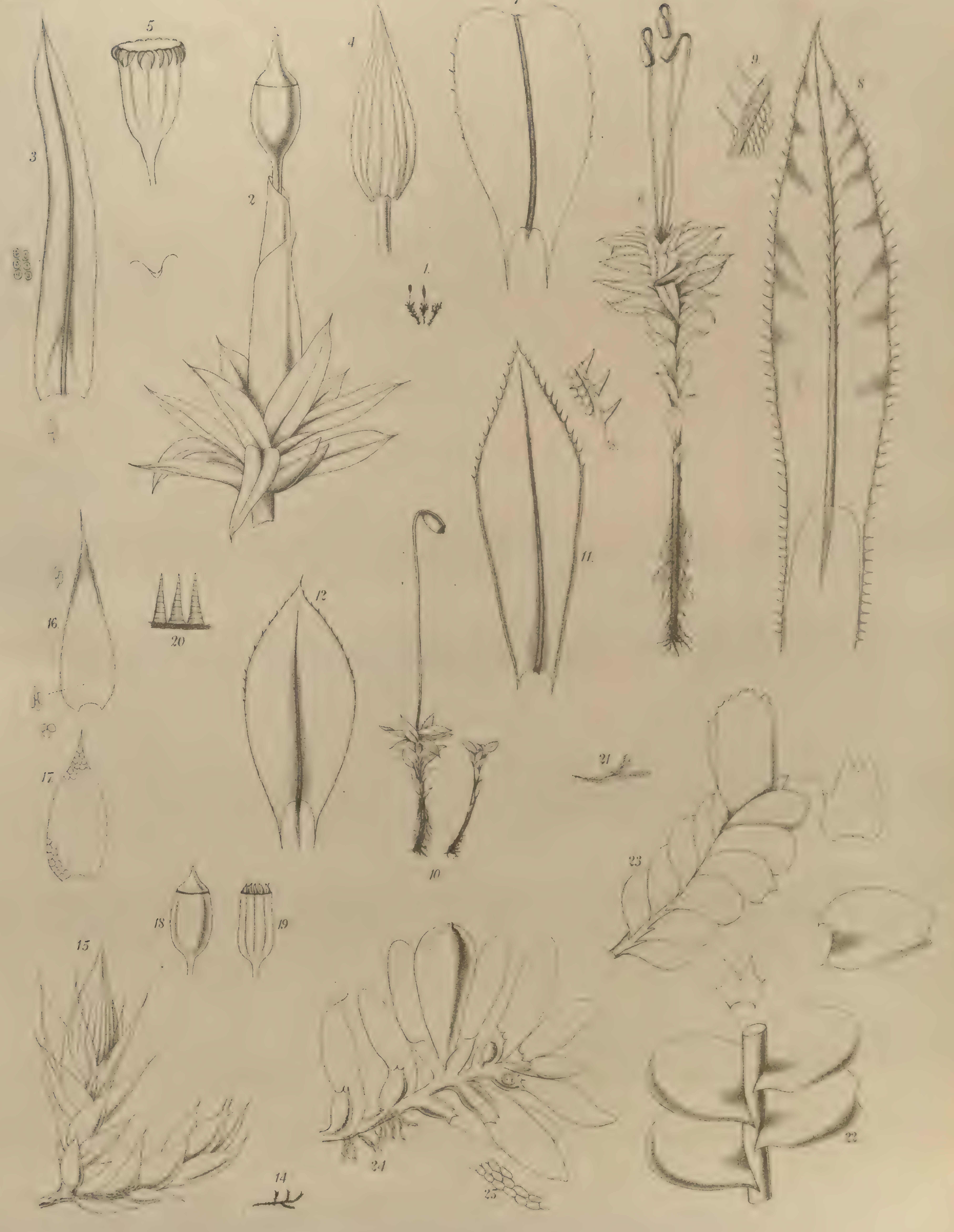
Figs. 6–9. MNIUM SPECIOSUM.
- 6. Plant, natural size.
- 7, 8. Leaves, enlarged.
- 9. Margin of leaf, further magnified.

Figs. 10–13. MNIUM ACULEATUM.
- 10. Plant, fertile and male stems, natural size.
- 11 and 12. Leaves, enlarged.
- 13. Margin, further enlarged.

Figs. 14–20. ERPODIUM JAPONICUM.
- 14. Stem, natural size.
- 15. do. enlarged.
- 16, 17. Leaves, enlarged.
- 18, 19. Capsules.
- 20. Portion of peristome.

Figs. 21–23. LOPHOCOLEA COMPACTA.
- 21. Plant, natural size.
- 22. Portion of stem with leaves and stipules, enlarged.
- 23. Fertile branch with perianth, stipule, and leaf, enlarged.

Figs. 24, 25. LEJEUNIA MINUTA.
- 24. Portion of plant, enlarged.
- 25. Cells of leaf, further enlarged.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Mitten del. Fielding sc.

MOSSES OF JAPAN.

Mintern Bros. imp.

LINNEAN SOCIETY OF LONDON.

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	Part VI. 1888.	0	6	0	0	4	6
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	Part II. 1887.	1	8	0	1	1	0
	Part III. 1888.	0	16	0	0	12	0
V.	Part I. 1888.	0	12	0	0	9	0
	Part II. 1888.	0	5	0	0	3	9
	Part III. 1889.	1	7	0	1	0	0
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	Part III. 1883.	0	10	0	0	7	6
	Part IV. 1883.	0	3	0	0	2	3
	Part V. 1883.	0	3	0	0	2	3
	Part VI. 1884.	0	13	6	0	10	0
	Part VII. 1884.	0	9	6	0	7	0
	Part VIII. 1884.	0	10	0	0	7	6
	Part IX. 1886.	0	7	0	0	5	0
	Part X. 1887.	0	3	4	0	2	6
	Part XI. 1886.	0	6	0	0	4	6
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	Part XIII. 1887.	1	7	0	1	0	0
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THE

TRANSACTIONS

OF

THE LINNEAN SOCIETY OF LONDON.

ON NEW SPECIES OF CAULERPA, WITH OBSERVATIONS ON THE POSITION OF THE GENUS.

BY

GEORGE MURRAY, F.L.S.

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October 1891.

IV. *On new Species of* Caulerpa, *with Observations on the Position of the Genus.*

By GEORGE MURRAY, *F.L.S.*

(Plates LII. & LIII.)

Read 5th March, 1891.

THE exact position of the genus *Caulerpa* among the *Siphoneæ* has always been a matter of uncertainty. The vegetative characters by which it is sharply distinguished from the other *Siphoneæ* are of so singular a kind that little beyond the multinucleate siphoneous thallus is shared with other members of the group. Its reproduction—I do not speak of the vegetative propagation by the separation of shoots, which teaches us nothing of the least moment as to the relationship of the type—is a mystery that has baffled the curiosity of investigators. Its position within the group, therefore, has always depended more or less on the taste and fancy of writers. The conspicuous character of the genus, in which the outward forms of higher plants are closely reproduced, has always drawn the attention of botanists. The wonderful resemblances to mosses, to lycopods, to coniferous and cactaceous plants, and even to the typical foliage of other flowering plants would have been in other circumstances inevitably attributed to some of those mysterious forces called "protective resemblance" and the like, so incalculable in their operations except in the mind of the subjective naturalist. There is fortunately no room here for such speculations, and we may be content with the view that Nature appears to have executed in the forms of this genus a *tour de force* in exhibiting the possibilities of the siphoneous thallus—in showing that it is possible for a unicellular organism to display the varied beauties of outward form characteristic of highly-organized types; to attain by means of a lattice-work of cross-beams within the cell-body that mechanical support effected by transverse septa and separate, differentiated cellular structures for other Algæ and for the higher plants.

In seeking for grounds on which to assign a definite systematic position to the genus one naturally looks first to a small section of it to which several writers have attributed separate generic rank under the name of *Stephanocœlium.* This form varies in a marked degree from the typical *Caulerpæ*, and it is precisely here that affinity with other forms might successfully be sought for. The species *C. verticillata*, J. Ag. (=*Stephanocœlium verticillatum*, Kuetz.,=*Herpochæta charoides*, Harv.), at first sight with the naked eye, is certainly suggestive of the verticillate *Dasycladeæ*; but the resemblance amounts to no more than a suggestion which is after all equally applicable to other verticillate *Siphoneæ*, such as are found among *Valoniaceæ*—for example, *Chamædoris annulata.* This resemblance to the *Valoniaceæ* has been one of which, for reasons difficult to define, I have always taken a favourable view, strengthened by observation of several species in the living state and their mode and habit of growth. I now propose to submit reasons, of a modest character certainly, but yet I trust of some weight, for believing that such an affinity exists.

A few weeks ago Mr. E. M. Holmes brought to me a form of *Caulerpa* which he believed on good grounds to be undescribed. He very kindly handed it over to me for description, and I have much pleasure in now formally making it known under his name as follows:—

Caulerpa Holmesiana, n. sp. (Plate LII. figs. 1 & 2); frondibus a surculo repente annulatim constricto erectis, irregulariter ramosis, annulatim constrictis, rhachide rugulosa inferne nuda superne pinnata, pinnis oppositis eximie patentibus, falcato incurvis, in apiculum evidenter productis.

Hab. ad Algoa Bay, *Becker* !

In its branching and in the form of the pinnæ, even to the apiculate ends, this species very closely resembles *C. plumaris*, Ag., from which, on the other hand, it differs wholly in the character of the surculus and branches themselves. In *C. plumaris* and its allies these are terete and regular—in *C. Holmesiana* both surculus and branches are, as may be seen from fig. 1 *b*, annulate and rugose. This annulate structure is characteristic of *C. cactoides*, Ag., and of the base of the fronds of *C. ligulata*, Harv. (fig. 3, *a* & *b*). Viewed in section the stalks exhibit the lattice-work of cross-beams or strands of cell-membrane characteristic of *Caulerpa* (Plate LII. figs. 2 *a* & *b*, 3 *b*, 7 *a* & *b*, Plate LIII. figs. 2, 5, & 6), but except in this respect they call to mind very forcibly the outward appearance and structure of the basal cells of the *Valoniaceæ* named above, viz. *Struvea*, *Chamædoris*, and *Apjohnia*. A reference to fig. 4 (Plate LII.), which represents the basal cell of *Struvea plumosa*, shows this point—not only the strong outward resemblance, but the peculiar character of the thickening of the cell-wall—a structure previously described by Mr. Boodle and myself ('Annals of Botany,' vol. ii. p. 169) as fibrillar thickening. This process of thickening, which is carried so far in *Spongocladia* as to obliterate the lumen in some cases, is more or less characteristic of all *Caulerpæ* (see Plate LII. fig. 2, Plate LIII. fig. 5), and taken into account with the vesicular character of the fronds of many *Caulerpæ*, especially as they appear in the living state, it affords me grounds for thinking that we may have here an indication of the affinities of the genus. The use of such annulate constrictions accompanied by thickening of the wall is plainly the mechanical one of strengthening the stalk. It is found, as has been said, in *C. cactoides* (fig. 6), which has a large and comparatively heavy frond; in *C. ligulata* (fig. 3), of which this is even more true; in *Struvea*, *Chamædoris*, and *Apjohnia*, in each of which a single slender stalk supports an unwieldy frond. I admit that this point is a small one, but in the total absence of other indications it has appeared to me to be of sufficient moment to claim attention. The question cannot be wholly settled until the reproduction of *Caulerpa* has been discovered, and meantime we must be content with vegetative characters. If a connection with *Valoniaceæ* be admitted, I may be pardoned for pointing out the further relationship this connection implies. In a paper read before this Society on *Boodlea*, then a new genus of *Siphonocladaceæ* (Linn. Soc. Journ., Bot. vol. xxv. p. 243), I endeavoured to establish a connection of this group through *Boodlea* with *Microdictyon* &c., and with the jointed green Algæ (*Cladophora*, e. g.) through *Spongocladia*. Mrs. Weber van Bosse has since then, by her admirable research on *Spongocladia* and *Struvea* (Ann. Jard. Bot. Buitenzorg, vol. viii. (1889–90) p. 79), made this connection even closer, and what I then claimed to establish has since been accepted by Continental and other phycologists who have worked at this group. I refer to the matter now, not only in view of the subject of this paper, but to bring forward incidentally one more proof of this connection—which bears upon my argument directly. Mr. Holmes has furnished me with a specimen of *Cladophora rugulosa*, Martens, also from the Cape of Good Hope, which possesses such a rugose basal cell, from which the frond filaments arise in dichotomous series.

A closer examination of this species discloses the fact that not only is the basal cell elongated and entirely aseptate, but it is similarly thickened, though more slightly. Besides the basal cell, the basal portions of the upper joints are all similarly rugose, and the whole structure and appearance of the plant so strongly correspond with Harvey's genus *Apjohnia* that I have no hesitation in transferring *Cladophora rugulosa* to *Apjohnia*—as *Apjohnia rugulosa*. It is of equal height with the already existing *Apjohnia læte-virens*, Harv., but the filaments are much more slender, and the habit of the plant is therefore like that of *Cladophora*. A minute study of the development of the branches in these Valoniaceous genera, especially in *Apjohnia*, is much to be desired. This species (*A. rugulosa*) is more accessible at the Cape than *A. læte-virens* appears to be, and we may therefore hope for light on the subject. In founding the genus, Harvey (Phyc. Austr. tab. v.) says: "At first sight the plant here figured (viz. *A. læte-virens*) may pass for a very robust species of *Cladophora*, of the division to which *C. pellucida* belongs. But a closer examination reveals characters which force us to remove it far from *Cladophora*, and to associate it with the small group of confervoid Algæ which is typified by *Valonia*. These characters are—the branching fibrils, that issue from the base of the first-formed cell; the annular constrictions of the cells, both primary and those afterwards formed; the deposition of carbonate of lime, as a superficial coating; the watery contents of the cells; and, finally, the mode of development." With regard to the last of these characters, it is, as I have said, desirable that we should know more than Harvey has been able to tell us. As for the coating of carbonate of lime in *Apjohnia*, as in *Struvea* and in *Chamædoris*, this is produced by the growth of incrusting Corallineæ; and in point of the other characters *A. rugulosa* closely corresponds in all respects (see fig. 5). I have no doubt of the identity of the plant given to me by Mr. Holmes with Martens's species, having compared it with his figure and description in 'Die Preussische Expedition nach Ost-Asien,' Botan. Theil, p. 112, tab. ii. fig. 3, where Martens tells us that it had been collected by Dr. Krauss at Port Natal, as well as at Yokohama. Mr. Holmes's specimen comes from Algoa Bay, where it was collected by Mr. Becker.

This character of annulate constrictions is, then, of frequent occurrence among

Siphonocladaceæ, and it may at all events have value in the absence of other evidence. It is possible to bring to bear against this view of the relationship of *Caulerpa* with the Valoniaceæ an argument founded on the notable resemblances of outward form to diverse higher plants exhibited by *Caulerpa*, and to conclude that, since these express no relationship, neither should the present instances be held to do so. But, as I need hardly point out, these resemblances are superficial, while the one I rest upon corresponds in minute structure as well, and, moreover, the resemblance is to plants which every one admits to be on other grounds closely allied.

Appended to Harvey's description of *Caulerpa cactoides*, Ag. (Phycologia Australica, tab. xxvi.), is a note to the following effect:—"In the distribution of my Australian duplicates I have referred this species to *C. corynephora*, Mont., and, I think, correctly; for though the figure given by Dr. Montagne represents a smaller and rather more slender specimen than the one here chosen for illustration, it differs in no essential character; and some of my Australian specimens are equally small and narrow. My reference to the earlier *C. cactoides* of Brown and Turner is open to graver objections, and yet I cannot persuade myself that the plant now figured is not identical with what they had in view; for our plant abounds along the whole coast visited by Dr. Brown, and could not well have escaped his notice, whereas no specimen quite agreeing with Turner's figure and description has been found by recent collectors who have carefully explored the Australian shores. I suppose, therefore, that Turner had before him a badly dried and possibly distorted specimen, and was thus led to figure and describe the ramenta as 'imbricated on all sides,' and not strictly *distichous*, as they invariably are on all the many specimens I have examined. In all other respects our plant sufficiently agrees with Turner's description, and the name *cactoides* is quite expressive of its succulent and robust characters."

There has always been some doubt as to these points; and Agardh (Till Alg. Syst. i. p. 44), in his monograph of *Caulerpa*, has indicated uncertainty as to the identity of *C. corynephora*, Mont., with *C. cactoides*, and De Toni (Sylloge, vol. i. p. 485) has followed him. The origin of all the uncertainty is no doubt Dawson Turner's figure on tab. 171 of his 'Fuci,' referred to by Harvey in the above passage. Fortunately the very specimen figured by Dawson Turner is preserved in Robert Brown's Herbarium in the British Museum, and it unmistakably shows the source of his error. Turner had not the excuse of a "badly dried" or "distorted" specimen as Harvey charitably supposes—he simply attempted to figure as it was a rather short and branching specimen, of which the branches plainly overlie. From the nature of this branching it would be impossible to otherwise dry or display it—and Dawson Turner, having imperfectly examined it, concluded hastily that the ramenta were "imbricated on all sides;" it was simply an error resulting in a bad figure, by no means worthy of a place in the author's splendid contribution to the founding of Phycology. Harvey was therefore right in his surmise that his plants were the same as Robert Brown's, and I have much pleasure in bearing this direct testimony to it (see Pl. LII. figs. 6 & 7). As to *C. corynephora*, Mont., we must hold it also to be the same species. No doubt Montagne was naturally misled in the same way as to the position of the ramenta of

C. cactoides when he founded his species. He expressly says, "Cette espèce, qu'à la première vue on pourrait confondre avec plusieurs autres de la deuxième section d'Agardh *, se distingue de toutes par la position distique de ses pinnules, et par conséquent appartient à la première section, à celles des *Taxiformes*. Elle diffère donc des *C.C. clavifera, cactoides*, etc., absolument," &c. (Voyage au Pôle Sud, Dumont D'Urville, vol. i. p. 15, tab. 6. fig. 2.)

We need, therefore, hesitate no longer as to the identity of these species. *C. cactoides*, however, is a variable form, and this is shown especially by a specimen collected by Mr. George Clifton, R.N. (whose work in collecting the Algæ of Western Australia was so handsomely recognized by Harvey in many ways), and recently presented by him to the British Museum with his collection of Algæ. It has been mentioned above that *C. cactoides* is distinguished by the possession of an annulate stalk, while it may be added that the type and other specimens examined by me have a terete and smooth surculus. Mr. Clifton's specimen (Pl. LII. fig. 8) has not only this character of stem, but the surculus is similarly annulate, and the fronds are tall and unbranched. I have therefore resolved to regard this as a variety of *C. cactoides*.

CAULERPA CACTOIDES, Ag., var. GRACILIS (Plate LII. fig. 8); frondibus a surculo repente annulatim constricto erectis simplicibus, elongatis, gracilibus.

Hab. ad oras occident. Novæ Hollandiæ, *Clifton*!

Before leaving the history of this species, I should like to add a remark which I am sure will interest the Linnean Society. It has been said that the original specimen of *C. cactoides* is the one collected by Robert Brown. He had called it, as Dawson Turner says, by the specific name of "*Opuntia*," but Turner does not allude to the generic name used by Brown, viz. *Actaia*. In those days when most Algæ were reckoned under *Fucus*, Brown had not only separated this and other forms by such names in his herbarium, but the truly remarkable thing is that he reserved this name *Actaia* for *Siphoneæ*, and further he applied it to them however diverse their outward forms. Let me give an example—he calls *Polyphysa peniculus* "*Actaia peniculus*," and the observation proves that he, at this early date, not only recognized the separate character of the *Siphoneæ* from other Algæ, but he traced this character through most diverse forms. Brown never published this observation, nor can I find any manuscript of his treating of it; but it exists in his herbarium in his own handwriting, and its significance is plain enough. It is interesting, therefore, to put on record now the fact that this great botanist, in addition to his other achievements, first perceived the separate character of this interesting group, and founded it (though privately) in his own herbarium under the name of "*Actaia*."

Closely related to *C. cactoides* is another form new to science. It was collected in Ceylon by the late W. Ferguson, and is no. 415 of his herbarium (as distributed). Dr. Grunow has recognized by a MS. name the distinct character of this plant, for which he has proposed the name of var. *Fergusonii*. However, it differs not only in the stalk and surculus having neither of them annulate constrictions, but also in the form of the ramenta, which are much shorter and ovate, while those of *C. cactoides* are distinctly club-shaped (Plate LII. figs. 6 & 8, Plate LIII. fig. 1). I have therefore given it specific rank as follows:—

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* *I. e.* C. Agardh.

Caulerpa Fergusonii, n. sp. (Plate LIII. figs. 1 & 2); frondibus a surculo repente glabro, continuo erectis difformibus, simplicibus, rhachide inferne tereti, subdistiche ramentaceis, ramentis oppositis, ovatis, strictura conspicua a rhachide sejunctis.

Caulerpa cactoides, var. *Fergusonii*, Grun. in litt.

Hab. ad Ceylonam, *Ferguson* ! no. 415.

This species is most closely allied to *C. cactoides* on the one hand, and on the other it forms a link between this species and *C. sedoides*, which it resembles in stature, being considerably slighter than *C. cactoides*. At first sight it strongly resembles Montagne's figure of his *C. corynephora* noted above, but a close inspection of this figure shows indications of annulate constrictions of the rhachis, and moreover the form of the leaves is distinctly clavate.

There remains one more species for me to describe, and it is, perhaps, the most beautiful of all even of this genus.

Caulerpa phyllaphlaston, n. sp. (Plate LIII. figs. 3–6); frondibus a surculo repente crasso annulatim subconstricto erectis, ramosis, dichotomis; ramis elongatis, pennatis, distiche ramentaceis; ramentis regulariter alternis, unilateraliter pinnatis, pinnis superis in una serie dispositis, acuminatis, elongatis.

Hab. ad Progresso, Yucatan, *Schott* ! no. 345.

I have used the specific name "*phyllaphlaston*" in allusion to the stern ornament (ἄφλαστον) of ancient Greek ships, to which the one-sided branching of the ramenta bears a strong resemblance. There is no section in the excellent Agardhian arrangement of the species of this genus into which *C. phyllaphlaston* naturally falls. It approaches most nearly to the sections "Filicoideæ" and "Hippuroideæ." From the former it diverges in the ramenta being clothed with pinnæ; in the *Filicoideæ* they are the ultimate branches. The ramenta of the *Hippuroideæ* bear pinnæ, but the rhachis is clothed with the ramenta on all sides (e. g. *C. Sonderi*, F. Muell.); while in *C. phyllaphlaston* the ramenta are distichous and alternate. The species is therefore exactly intermediate between these sections, and strikingly unites them. Were it a case of genera instead of sections, the proper step would be to permit one or the other to disappear; but since it is an affair of the artificial arrangement of species within a genus, it promotes no convenience to enlarge the sections, but rather the reverse. I am therefore compelled to propose another section called *Bipinnatæ*, characterized by distichous ramenta, which shall be in turn pinnate—either completely pinnate or unilateral. There are from twenty to thirty of these unilateral pinnæ on each of the primary pinnæ in *C. phyllaphlaston*. In the dried specimens the stalks have a reddish-brown colour, and the pinnæ a vivid green. The species is exceedingly handsome, and one is tempted to think it must have a limited range. The Florida Keys have been examined by so many thoroughly expert phycologists from Harvey downwards that a plant of its size and striking appearance can hardly have been overlooked. The same is true of several of the Antilles, notably Guadeloupe. It reminds one that the mainland coast of the Caribbean Sea from Yucatan round to La Guayra has never been properly examined, and affords the phycologist a pleasing anticipation of the results of such an exploration.

DESCRIPTION OF THE PLATES.

PLATE LII.

Fig. 1. *Caulerpa Holmesiana.* *a.* Nat. size. *b.* A branch, × 3. *c.* Tip of pinna.

Fig. 2. *Caulerpa Holmesiana.* *a.* Transverse section of stalk, × 25. *b.* Longit. section, × 50.

Fig. 3. *Caulerpa ligulata.* *a.* Nat. size. *b.* Longit. section through annulate stalk, × 25.

Fig. 4. Annulate basal cell of *Struvea plumosa.* Nat. size.

Fig. 5. Basal cell and branches of *Apjohnia rugulosa.* × 3.

Fig. 6. *Caulerpa cactoides,* showing annulate stalk. Nat. size.

Fig. 7. *Caulerpa cactoides.* *a.* Transverse section through stalk, × 15. *b.* Longit. section through stalk, × 15.

Fig. 8. *Caulerpa cactoides,* var. *gracilis,* showing annulate stalk and surculus. Nat. size.

PLATE LIII.

Fig. 1. *Caulerpa Fergusonii.* Nat. size.

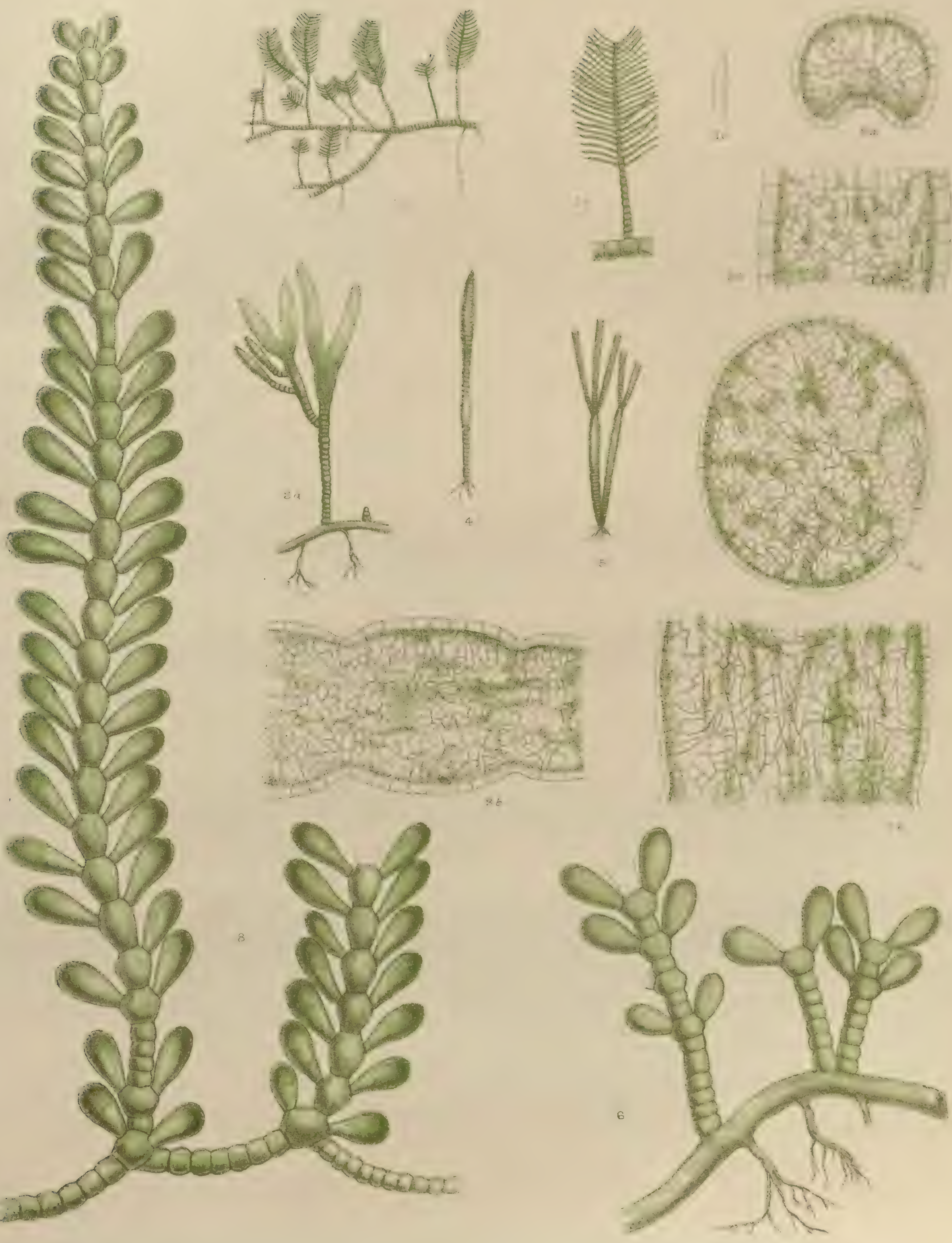
Fig. 2. *Caulerpa Fergusonii,* section through surculus (much compressed). × 15.

Fig. 3. *Caulerpa phyllaphlaston.* Nat. size.

Fig. 4. *Caulerpa phyllaphlaston.* Unilateral pinnæ. × 12.

Fig. 5. *Caulerpa phyllaphlaston.* Transverse section through surculus, showing a double wall on one side (the cross-beams from the outer perforate the inner wall). It is possible that the space between the walls has been produced by the disintegration of a portion of the wall; there occurs in it a yellowish gummy substance. × 20.

Fig. 6. *Caulerpa phyllaphlaston.* Longit. section through stalk. × 20.



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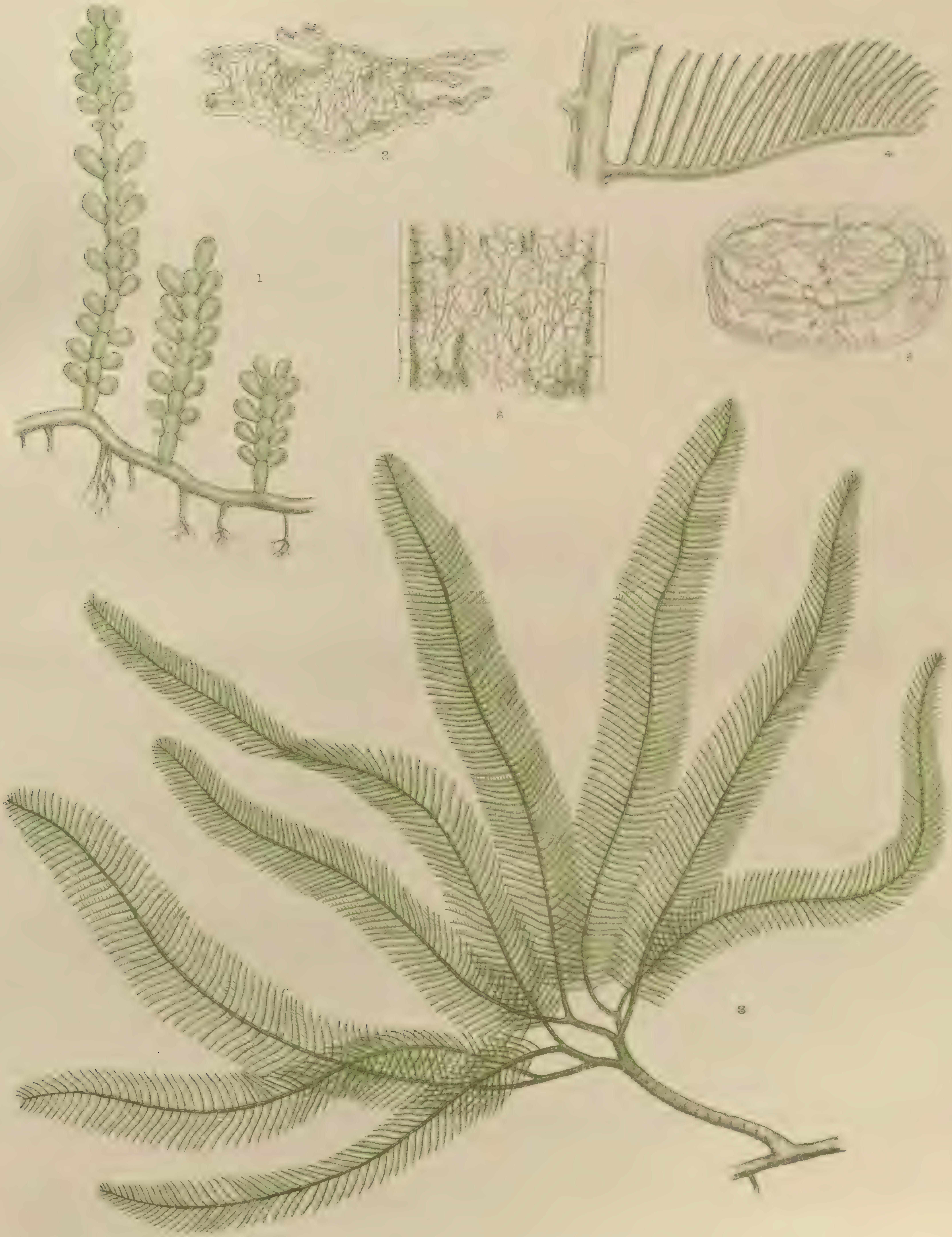
NEW SPECIES OF CAULERPA.



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NEW SPECIES OF CAULERPA.

LINNEAN SOCIETY OF LONDON.

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	Part XIV.	1885.	0	6	0	0	4	6
	Part XV.	1885.	0	4	6	0	3	6
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II.	Part I.	1881.	0	12	0	0	9	0
	Part II.	1882.	0	5	0	0	3	9
	Part III.	1883.	0	10	0	0	7	6
	Part IV.	1883.	0	3	0	0	2	3
	Part V.	1883.	0	3	0	0	2	3
	Part VI.	1884.	0	13	6	0	10	0
	Part VII.	1884.	0	9	6	0	7	0
	Part VIII.	1884.	0	10	0	0	7	6
	Part IX.	1886.	0	7	0	0	5	0
	Part X.	1887.	0	3	4	0	2	6
	Part XI.	1886.	0	6	0	0	4	6
	Part XII.	1886.	0	8	0	0	6	0
	Part XIII.	1887.	1	7	0	1	0	0
	Part XIV.	1887.	0	7	0	0	5	0
	Part XV.	1887.	0	10	0	0	7	6
	Part XVI.	1888.	0	2	6	0	2	0
III.	Part I.	1888.	3	12	0	2	14	0
	Part II.	1891.	0	5	0	0	3	9
	Part III.	1891.	0	7	0	0	5	0
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THE

TRANSACTIONS

OF

THE LINNEAN SOCIETY OF LONDON.

A SYSTEMATIC AND STRUCTURAL ACCOUNT OF THE GENUS TURBINARIA, LAMX.

BY

ETHEL SAREL BARTON.

(*Communicated by* D. H. SCOTT, Ph.D., F.L.S.)

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October 1891.

V. *A Systematic and Structural Account of the Genus* Turbinaria, *Lamx.*

By Ethel Sarel Barton. (*Communicated by* D. H. Scott, *Ph.D.*, *F.L.S.*)

(Plates LIV. & LV.)

Read 5th March, 1891.

THE genus *Turbinaria* was founded by Lamouroux in 1825 (Dictionnaire classique d'Histoire Naturelle, tom. vii. p. 71). He furnished no generic diagnosis and no figure, but it is plain enough that his generic type is the *Fucus turbinatus* of Linnæus. The first record, however, of this alga is earlier than Linnæus, and occurs in Sir Hans Sloane's 'Natural History of Jamaica,' A.D. 1707, p. 58, where he describes the "Fucus marinus vesiculas habens membranis extantibus alatas," and figures it on tab. 20. fig. 6. Sir Hans says, "This has a dark coloured, tough, roundish, crooked Stem, about nine Inches high, having many crooked Twigs very thick set, with Bladders full of Air. The Bladders themselves are roundish, or rather Triangular, having an extant *foliaceous* membrane at top encircling it, and three other extant *alæ* underneath, making it look Triangular, or something of the shape of a Funnel, being pyramidal, and of a dark brown Colour, or blackish when dry'd like Glew, smelling strong of the Sea, and tasting salt like other Fuci. Besides it has several round small Protuberancies over its surface, supposed to be the Seed. It grows on the Rocks, covered with the Sea, on all the Coasts of this Island." The excellent figure quoted leaves the reader in no doubt as to the identity of the form. I have, however, been permitted to examine the very specimen figured by Sir Hans, in his herbarium in the British Museum. Rumph, in the 'Herbarium Amboinense,' vi. p. 185, mentions a seaweed which is in all probability a *Turbinaria*, but it is impossible to speak with any degree of certainty as to the species. The *Fucus turbinatus* of Linnæus is the next record, and a perusal of the description shows that the plants are at all events congeneric with Sloane's. Linnæus quotes Sloane, but it will be seen from the systematic account which follows that they were dealing with different species. Linnæus's type, preserved in his herbarium, enables me to decide this point. We next find mention made of this type in the *Fucus conoides* of Forskål (Flora Ægyptiaco-arabica, p. 192). An authentic specimen of Forskål's exists in the British Museum, and from an examination of it, I am enabled to decide that it constitutes a third species of this genus. We next come to Dawson Turner's *Fuci*, in which he quotes the *Fucus turbinatus* of Linnæus, and adds a var. β, *ornatus*, to it. Most unfortunately Dawson Turner, to judge by his excellent figure and by his specimens preserved in the Kew Herbarium, was dealing with a different plant from Linnæus. His *Fucus turbinatus*, which he believed to be identical with Linnæus's, is in point of fact the same as the *Fucus conoides* of Forskål. Subsequent writers, quoting Dawson Turner, have thus been misled, and I have ventured, from a comparison of these authentic specimens, to place them in what I conceive to be their proper positions. Lamouroux, who founded the name *Turbinaria*, the elder Agardh, Bory de St. Vincent, and others next attacked the subject and each other; at all events

Bory unsparingly criticised the value of the specific characters adopted by his predecessors, with the result that he established among others a species, *T. denudata*, which made confusion worse confounded; it has now disappeared into the limbo of synonymy. J. G. Agardh first really introduced order into the genus (Spec. Gen. et Ord. Algarum, p. 265), and Kützing (in the 'Tabulæ Phycologicæ,' Bd. x. p. 24) followed in his path, raising certain of the Agardhian varieties to specific rank. Briefly, my present contribution to our knowledge of *Turbinaria* recognizes and maintains the work of Agardh and Kützing, with the exception that one of the Agardhian varieties adopted as a species by Kützing now disappears, together with another species of Kützing; and, moreover, I have ventured to describe three new species and two new varieties of this small genus, which I hope may not be considered an extravagant addition. The species and varieties are all very closely connected with each other, and it is possible to determine them only after minute examination. Herbarium specimens should be moistened in warm water to exhibit the winged and dentate characters. In the British Museum, besides Sloane's and Forskål's specimens, I have examined material collected by Harvey and by Ferguson in Ceylon; by Mr. Thurston in the Gulf of Manaar; by Dr. Falconer at Mangalore; by an unknown collector (herb. Dickie) and Dr. Prain in the Andaman Islands; by Schimper and by Sir Gardner Wilkinson, in the Red Sea, and also specimens ex herb. Hohenacker from the same basin; by Hildebrandt on the Somali coast and Madagascar; from Agalagas, ex herb. Montagne; by Colonel Pike in Mauritius; from Ile de Bourbon, ex herb. R. Brown; from Seychelles by H.M.S. 'Alert'; by Balfour from Rodriguez; from Torres Straits by Prof. Haddon; from New Guinea by Capt. Sir E. Belcher; from Australia by Robert Brown, Sir Ferdinand von Mueller, and by Labillardière; from Mangaia by Rev. Mr. Gill; from the Friendly Islands by Capt. Sir E. Home; from other Pacific Islands by H.M.S. 'Challenger'; from the West Indies by M. Mazé. At the Herbarium, Royal Gardens, Kew, I have seen also specimens collected at Diego Garcia by Mr. Bourne; at Madras by Wight; at Macao ex herb. Hooker; at Samoa by Powell; at Howick's Group by Sir F. von Mueller; and at Swan River by Lady Broome, besides the specimens of Dawson Turner, of such historical value.

Mevrouw Weber van Bosse has with great kindness sent me her collection made by herself in the Malay Islands, and from it I have described one new species and two new varieties, one of the latter bearing her name.

The other two new species were described from material in the British Museum, but one was from a unique specimen. However such is the value of Mevrouw Weber van Bosse's collection that I have found in it additional specimens of this interesting and rare *Turbinaria*. I wish to record my great indebtedness to her for her help with material, and my sense of her kindness.

Systematic Disposition.

TURBINARIA, Lamx. in Dict. Class. d'Hist. Nat. tom. vii. p. 71.

Caulis simplex vel ramosus, folia et receptacula gerens; foliis petiolo tereti aut triquetro aut trialato, interdum in vesiculam intumescente, laminam peltatam triquetram vel orbicularem sustinente; receptacula racemosa vel corymbosa in axilla folii emergentia; dioica vel monoica, interdum hermaphrodita. Radix fibrosa.

The distribution of the genus extends through tropical and temperate seas, though never reaching further south than the Cape and Western Australia, or further north than the China seas; otherwise it is confined to the tropics. Two species, *T. tricostata* and *T. trialata*, are West Indian, and the latter of these occurs also in the Indian Ocean, at the Cape, and on Australian shores, while *T. tricostata* also occurs in Eastern seas, in the form of var. *Weberæ*, near Batavia. The others are all oriental. Its distribution recalls that of its ally *Sargassum*, only it is very much more limited in range. For example, we have only two species in the Atlantic, and these reach no further north than the West Indies, and are therefore absent from the Mediterranean. All the species occur in Eastern seas (seven of them exclusively there so far as is known), and three of these reach Australia, while three occur in China seas. The genus, therefore, has reached its greatest development in point of variety of form and geographical range in warm Eastern seas.

1. T. CONOIDES, Kütz. Tab. Phyc. vol. x. p. 24, tab. 66. Caulis ramosus, ramis elongatis cylindraceis, vesicularum petiolo obconico obsolete marginato, lamina lata, dentata, subecostata terminato; receptaculis ramoso-cymosis. (Tab. LIV., fig. 1.)

Fucus turbinatus, L. Sp. Pl. ii. p. 1160; Syst. Nat. ed. 12, ii. p. 715; Syst. Nat. ed. J. G. Gmel. ii. p. 1380; Hort. Cliff. p. 478; Esper, Icon. Fuc. p. 29, tab. ix.; S. Gmel. Hist. Fuc. p. 97, tab. 5. fig. 1.

Turbinaria denudata, Bory, Voyage de la 'Coquille,' Bot. p. 117 (partim).

Turbinaria vulgaris, var. *conoides*, J. Ag. Spec. Gen. et Ord. Alg. vol. i. p. 267.

Hab. Ad ins. Sumatra, *Ekeberg*! in Herb. Linn. Singapore, *Marchesetti*! Ad Birakeké, Celebes, *Domina Weber van Bosse*! In oceano Indico ad Zeylonam, *Ferguson*! nos. 82 (et 83 partim); in sinu Manaar, *Thurston*! Mangalore, *Falconer*! Ad Chinam, *Herb. Binder.* In fretû Torres, *Haddon*! Ad oras bor. Novæ Hollandiæ, *R. Brown*! Ad oras Novæ Hollandiæ, *Herb. F. von Mueller*! et ad ins. Mangaia, *Gill*! Ad litt. Kamtschatica, *Stellerus* fide Gmelin.

Var. EVESICULOSA, mihi; petiolo triquetro emarginato, vesiculis nullis.

Hab. Ad ins. Edam et Enkhuizen prope Bataviam, Domina Weber van Bosse legit!

2. T. DECURRENS, Bory, Voy. de la 'Coquille,' Bot. p. 119. Caulis ramosus, ramis elongatis cylindraceis, vesicularum petiolo obpyramidato, angulis alatis, dentatis, in laminam peltatam hinc costatam continuatis; receptaculis subracemosis.

Fucus conoides, Forskål, Flora Ægyptiaco-arabica, p. 192.

Fucus turbinatus, Turn. Fuci, vol. i. p. 50, tab. 24. figs. *a* et *b*.

Turbinaria vulgaris, var. *decurrens* et var. *triquetra*, J. Ag. Spec. Gen. et Ord. Alg. vol. i. p. 267.

Turner quotes *Fucus turbinatus*, L., as this species, and later writers have been content to quote Turner. However, from a comparison of the Linnean type-specimens with Dawson Turner's figures and specimens, it is plain that they are not the same species. Fig. *b* of Turner shows the winged and dentate petiole of *T. decurrens*, and this is absent in the Linnean specimens, which agree exactly with *T. conoides*, Kütz. Dawson Turner's own specimens preserved in Herb. Kew are certainly *T. decurrens*.

Hab. In mari Rubro, *Forskål*! *Sir Gardner Wilkinson*! *Schimper*! (no. 936 ad oppidum Kosseir, no. 458 prope El-Tor in arena repens, et no. 955 prope Noweba), *Hohenacker*! (Meeralgen, no. 168). In oceano Indico, ad oras Somalienses, *Hildebrandt*! (no. 7 Flora exsicc. Africæ orient.); ad ins. S. Andaman, *Herb. Dickie*! Ad ins. Diego Garcia, *Bourne*! In fretû Torres, *Haddon*! Ad litt. Novæ Guineæ, '*Challenger*'! Ad Chinam, *Herb. Binder*.

3. TURBINARIA MURRAYANA, n. sp. Caulis simplex, brevis, crasso foliorum petiolo latissime alato dentato triquetro obpyramidato, in laminam peltatam concavam serratam continuato, vesiculis nullis; receptaculis corymbosis. (Tab. LIV. fig. 2.)

Hab. Ad novam Guineam, *Capt. Sir E. Belcher* legit! (in *Herb. Mus. Brit.*); ad Macassar, *Domina Weber van Bosse*!

I have named this new species in honour of Mr. George Murray, of the British Museum, who first drew my attention to it as probably an undescribed form. Its nearest ally is *T. decurrens*, from which it differs in having a short, thick, unbranched stem, in the absence of vesicles and the arrangement of the receptacles.

4. T. TRIALATA, Kütz. Tab. Phyc. vol. x. p. 24, tab. 67. Caulis laxe ramosus, ramis abbreviatis, vesicularum petiolo elongato trialato, apice inflato, laminam peltatam acute dentatam vel obsolete denticulatam sustinente; receptaculis racemosis.

Fucus marinus vesiculas habens membranis extantibus alatas, Sloane, Nat. Hist. Jamaica, p. 58, tab. 20. fig. 6.

Turbinaria vulgaris, var. *trialata,* J. Ag. Spec. Gen. et Ord. Alg. vol. i. p. 268.

Turbinaria heterophylla, Kütz. *loc. cit.* p. 25, tab. 69. fig. 1.

Hab. In mari Indiæ occident. ad ins. Jamaica, *Sloane*! Guadeloupe, *Mazé*! no. 164. Key West, Florida, *Harvey*. Porto Rico, *Herb. Sintenis*! San Domingo, *Herb. Sond.*! In mari Indico "India orient.," *Herb. Greville*! In sinu Manaar, *Thurston*! Ad Madras, *Wight*! Singapore, *Kassel*! Seychelles, *H.M.S. 'Alert'*! In mari Chinensi, *Herb. Sond.*! Ad Macao, *Herb. Hook.*! Ad oras occident. Novæ Hollandiæ, *Labillardière*! Ad cap. Bonæ Spei, fide *Kützing*.

I have not maintained the two varieties *havanensis* and *capensis* of Kützing, since these appear to me to represent little more than growth-forms; intermediate specimens certainly exist. *Turbinaria heterophylla*, Kütz., also appears to come under this species. So far as one may judge from his excellent figure, it is an irregularly grown specimen of *T. trialata*, nearly related to the form he describes as var. *capensis*. I have examined the specimen of Sir Hans Sloane in the British Museum, and it also falls under *T. trialata*.

5. T. TRICOSTATA, n. sp. Caulis laxe ramosus, ramis abbreviatis, foliorum petiolo tenui trialato (sed in statû juvenili tereti) dentato laminam orbicularem tricostatam serratam sustinente, vesiculis nullis; receptaculis corymbosis. (Tab. LIV. fig. 3.)

Hab. Ad ins. Guadeloupe, *Mazé* (nos. 190, 208, 396, 705 et 396 in Herb. Mus. Brit.). [No. 396 in Herb. Kew is *T. trialata*.] This species will be found quoted by these numbers under *Turbinaria vulgaris*, J. Ag., and under var. *decurrens* and var. *trialata* in MM. Mazé et Schramm's 'Essai de classification des Algues de la Guadeloupe,' pp. 132 & 133. Porto Rico, *Herb. Sintenis*! Ad ins. Bahama, *Palmer*!

This new species, which recalls both *T. decurrens* and *T. Murrayana*, differs from the former in the absence of vesicles and in the character of the branching, and from both in having a round lamina. From *T. Murrayana* it differs further in its branched stem, much more slender stem and leaves, and in having a tricostate lamina. From *T. trialata*, which name it has borne in M. Mazé's collection of Guadeloupe Algæ, it differs in the absence of vesicles and in having toothed wings to the petiole in the mature state.

Var. WEBERÆ, mihi; lamina triangulari, petioli angulis edentatis. (Tab. LIV. fig. 4.)

Hab. Ad ins. Edam et Enkhuizen prope Bataviam, Domina Weber van Bosse legit!

This variety shows the tricostate character of the lamina even more plainly than the typical form. Though the wings are edentate as a rule, occasionally *one* tooth may be found.

6. T. DENTATA, n. sp. Caulis ramosus, ramis abbreviatis, vesicularum petiolo subtriquetro angulis obsolete marginatis, vesiculis inflatis cum dentibus validis seriatim ornatis, laminam acute dentatam sustinente. (Tab. LIV. fig. 5.)

Hab. Ad Macassar, Domina Weber van Bosse legit!

This species approaches *Sargassum* in appearance more nearly than any of the others; in fact, so far as leaf characters go, it exhibits the appearance of a *Sargassum* without leaves, but with vesicles adorned with a crown of teeth, from which others descend in rows to the petiole.

7. T. ORNATA, J. Ag. Spec. Gen. et Ord. Alg. vol. i. p. 266. Caulis subramosus, foliis in petiolo triquetro peltatis, subconcavis, interdum in vesiculam intumescentibus, lamina peltæ dentibus validis marginata et alia serie superne coronata; receptaculis cymosis.

Fucus turbinatus, var. *β. ornatus*, Turn. Fuci, vol. i. p. 50, tab. 24. figs. *c–h*.

Sargassum turbinatum, var. *β*, Ag. Sp. Alg. p. 42, et Syst. p. 308.

Turbinaria denudata, Bory, Voy. de la 'Coquille,' Bot. p. 117 (partim).

Hab. In oceano Pacifico ad ins. Amicorum, *Capt. Sir E. Home*! Tahiti, '*Challenger*'! Ad ins. Admiralty, '*Challenger*'! Ovalau, Feejee, '*Challenger*'! Ad ins. Marianas, *Freycinet*. Ad oras Chilenses, *Bory*. Ad ins. Sandvicensium, *Herb. Binder*. Ad N. Zeelandiam, *D'Urville*. Ad ins. Samoa, *Powell*! Ad ins. Howick, *von Mueller*! In oceano Indico ad Zeylonam, *Harvey*! et Ferguson, no. 83 partim. In sinu Manaar, *Thurston*! Ad ins. Coco prope Andaman, *Prain*! Ad ins. Rodriguez, *Balfour*! Ad Nossi-bé, Madagascar, *Hildebrandt*, no. 56! Ad ins. Agalagas, *Herb. Montagne*! Mauritius, *Pike*! Ad ins. Bourbon, *Herb. R. Brown*. Ad Macassar et ad ins. Edam et Enkhuizen, *Domina Weber van Bosse*!

Dawson Turner, *loc. cit.* p. 51, says, "The var. β above described was found by Dr. Smith among some loose papers in the Linnean collection, but without any remark, or any clue that might lead to discover whence it came." In the Linnean Herbarium

I can find only one species, viz. *T. conoides*, but there are two sheets, on one of which there is no writing whatever. The latter may be the one referred to by Dawson Turner, but the plant is certainly not *T. ornata.*

8. TURBINARIA GRACILIS, Sond. in Bot. Zeit. 1845, p. 52, et Alg. Preiss. p. 18. Caulis subramosus, ramis retroflexis, foliis vesiculosis sphæricis, apice obtuso, membrana lata eximie dentata coronatis, receptaculis axillaribus ramosis.—*Kütz. Tab. Phyc.* vol. x. tab. 70.

Hab. Ad oras occident. Novæ Hollandiæ, *Preiss.*, et ad ins. Houtmann's Abrolhos, *R. Brown*! Ad flumin. Cygnis, *Domina Broome*!

9. T. CONDENSATA, Sond. in Kütz. Tab. Phyc. vol. x. p. 25, tab. 69. fig. 2. Caulis ramosus, ramis erectis vesiculis subcampanulatis, lamina eximie dentata, petiolo brevi-filiformi; receptaculis racemosis oblongis tuberculosis densissime congestis.

Hab. In mari Chinensi, *Herb. Sond.*

Turbinaria is a highly differentiated genus of Fucaceous algæ, closely allied to *Sargassum.* It grows, as its name implies, in the form of a cone; indeed, so much does it resemble the fructification of one of the higher plants, that a specimen of *T. Murrayana* was sent to the Botanical Department of the British Museum as a "water-logged cone." Since the different species are described in detail in the systematic portion of this paper, I propose to limit myself as regards the morphological structure to observations on *T. conoides*, the Linnean type, on which, for the most part, my investigations have been made (Pl. LIV. fig. 1). It is a plant growing to about the height of 10 inches. The stem, about $\frac{1}{8}$ inch thick, is upright and cylindrical, and, except in the lower part, which is bare, is densely crowded with leaves growing closely together all round the stem, thus giving the plant its characteristic appearance. The open spaces between the leaves are filled in with the receptacles, which grow in corymbose clusters from the base of the petiole. The roots are branched and grow densely crowded together at the base of the stem (*T. Murrayana*, Pl. LIV. fig. 2). The branching in *T. conoides* is monopodial. I use the word "leaf" advisedly, although it is a word we are accustomed to connect with the appendages of the sporophyte; but these shoots, though belonging to the oophyte generation (which so far as we know is alone represented in Fucaceæ), and therefore not in any way homologous with the leaves of vascular plants, still both resemble them in form and position, and perform the same office as assimilative organs to the Sargasseæ that leaves do to land-plants; and I have ventured therefore to use this word throughout the paper when referring to this growth. Oltmanns (Bibliotheca Botanica, Heft no. 14; Beiträge zur Kenntniss der Fucaceen, 1889, p. 56) prefers to use the terms "Basalspross" and "Flachspross" in his section of Sargasseæ (p. 54), but the benefit that is gained by having special words for this growth seems to be more than counterbalanced by the possible confusion that may arise in the employment of terms so indefinite.

Prof. Bower proposes to employ the terms "phyllidium" and "caulidium" when speaking of the oophyte generation, as opposed to "phyllome" and "caulome" of the sporophyte. According to this plan the respective organs of *Turbinaria* would fall under this new terminology; but, without disputing the advantages of such a plan, I think the words "leaf" and "stem" will serve my purpose equally well, the more so since Prof. Bower does not exclude the propriety of so using them.

I have compared *Turbinaria* with specimens in the British Museum Herbarium of the genera most nearly allied to it, viz.:—*Sargassum*, *Carpophyllum*, *Cystophora*, *Cystoseira*, and *Cystophyllum*. Each of these shows air-vesicles distinct from the leaf, but since, in many cases, I find the receptacles growing on either indiscriminately, I regard the vesicle as a metamorphosed leaf in all cases. A further proof of this is found in the fact that the vesicle in *Cystoseira Lepidium*, *Anthophycus longifolium*, and *Sargassum linifolium* is sometimes prolonged into a foliar structure, and sometimes again forms the central portion of a flattened leaf, showing that part of the leaf has become metamorphosed to form an air-float (see Kütz. Tab. Phyc. Bd. x. tab. 64, and Bd. xi. tab. 24). In the case of *Turbinaria* these two leaf-forms are represented in one, which unites in itself the two functions of an assimilative organ and of an air-vesicle.

I. *Stem.*—The main stem is composed of three distinct layers of tissue (Pl. LIV. fig. 6), as described by Wille ("Om Fucaceernes Blaerer," in Bihang till K. Svenska Vet. Akad. Handlingar, Bd. 14. Afd. iii. no. 4, Stockholm, 1889) in speaking of *Halidrys siliquosa*. The epidermal layer consists of the usual narrow radially elongated cells; beneath this is a band of thick-walled cortical parenchyma, which gradually passes over into the central strand or fascicular tissue. This latter occupies by far the largest proportion of the whole stem, and forms a thick strand of long narrow cells, resembling a vascular bundle of the higher plants, and probably, like it, performing the double office of supporting and of conducting tissue (Pl. LIV. figs. 7 & 8). The transverse walls of this tissue are extremely thin, and both in these and in the pits on the longitudinal walls there are perforations, through which I find that the protoplasm is continuous. Though I had at first suspected that the thin places in the cell-walls of this central strand were perforated, I was unable to prove it until I treated several sections after the method employed with so much success by Mr. Gardiner (Phil. Trans. Royal Soc. 1883, p. 821) on the endosperm of Palms, the pulvini of sensitive plants, &c. The section was soaked for a few seconds in strong sulphuric acid, then washed thoroughly in distilled water, after which I stained it with picric aniline blue. The sulphuric acid caused the cell-walls to swell, and the strands of protoplasm were seen passing in thin threads through the sieve-like perforations of the pits. This continuity is more plainly visible in the stem than in any other part of the plant, but this is possibly owing to the fact that the cell-contents were here better preserved.

Apex.—As regards the growth of *Turbinaria* I am only able to say that it is apical, but whether it is by means of a single cell or a group of initial cells the material at my disposal has not made it possible for me to decide. The meristematic region, as in other Fucaceæ, lies at the base of a depression covered in with young leaves densely crowded together, thus rendering the investigation of the growing point more difficult. I hope, however, at some future time, when I shall have more material suited for such investigation, to carry it out in its fullest details. The analogy of the receptacle to be subsequently described would lead us to expect a single apical cell in the vegetative stem also.

II. *Leaf.*—The leaf of *Turbinaria*, reduced to its simplest form, as found in *T. Murrayana* and in *T. tricostata*, which have no vesicle, appears to be a triangular shield or disk supported by a petiole, which joins it at the centre—a peltate leaf, in short. In the other species, of which *T. conoides* may be taken as the type, the matter is complicated by the development of a vesicle at the junction of stalk and lamina. When, in addition to this, the petiole is furnished with wings, as in *T. trialata*, and the vesicle is inflated, the appearance of a peltate leaf is much disguised. In *T. dentata*, which has distended vesicles and only a row of teeth, in place of regular wings, this character is harder to trace. The species of *Turbinaria*, however, fortunately for this purpose, run into each other in these points, and it is as easy to trace through the different species such gradations of form as it is difficult to draw hard-and-fast specific distinctions founded on these modifications.

The petiole consists of the same three layers of tissue (Pl. LIV. fig. 9) as the stem, and each tissue is continuous, the one with the other. Both in the central strand, however, and in the cortical parenchyma the cell-walls are much thinner than the corresponding tissues of the stem. The epidermal layer is continuous throughout.

The central tissue divides near the base of the vesicle into three distinct strands, and these run up the inside of the vesicle like the ribs of an inverted umbrella, subdividing meantime into numerous lesser strands, which anastomose and form a framework for the vesicular tissue. As they reach the lamina the subdivisions increase in number and run out to the edge, where they disappear and are lost in the parenchyma of which the lamina is composed (Pl. LIV. fig. 10). That part of the lamina which forms the roof of the vesicle is composed entirely of epidermis and parenchyma, and contains no fascicular tissue.

In comparing the leaf of *T. conoides* with a specimen of *T. ornata* devoid of vesicles, I found the course of the bundle slightly different in *T. ornata*, as might be expected. About halfway up the petiole the conducting tissue spreads out into the form of a triangle, the centre being filled with a large-celled medullary parenchyma, resembling the cortical tissue. From this triangle, the corners of which are marked by a large group of these small cells, strands run up the underside of the lamina (there being no vesicle in this species), and, as in *T. conoides*, gradually disappear as they approach the margin of the leaf. The three corners of the triangle are protected on the lower side by the ridges which support the lamina and give it a triangular shape. (Compare Pl. LIV. figs. 11 & 12.)

Development of Air-vesicle.—The air-vesicles are formed by a rending apart of the central tissue in the young leaves. In the earliest observed stages of the leaf the rows of cells run parallel to one another up the petiole into the lamina, which is then no broader than the petiole. As the lamina expands horizontally the central tissue is torn apart, and fragments of broken-down cells may be found in the half-formed cavity. In older leaves, where the tearing process has been completed, the cells bordering the edge of the cavity divide up meristematically and form a kind of secondary dermal layer (Pl. LV. fig. 1); lastly, in the fully-formed vesicles a cuticle peels off the internal surface of the walls of the cavity, and the cells beneath this cuticle grow out and protrude into the empty space (Pl. LV. fig. 2). It is possible that this layer of large papillate cells may serve for the secretion of mucilage; but it has been difficult to come to any conclusion on this point, since all my investigation has been necessarily done on spirit and dried material. In the parts of the cavity which are lined by the narrow-celled central strand, the same meristematic division takes place, the conducting-cells dividing on their free side and forming the large papillæ in the same way as is done by the cortical parenchyma. When I had finished making these observations on the formation of the vesicle in *Turbinaria*, I found that their schizogenetic development had been noted both by Dodel-Port (Biologische Fragmente, i. Theil, p. 12) and by Valiante (Fauna und Flora des Golfes v. Neapel, Leipzig, 1883, p. 9) in the case of *Cystoseira*. Neither of these authors, however, mentions the subsequent formation of the papillate layer lining the cavity, and I can find no instance in which this growth has been already noticed.

Vegetative Conceptacles.—There has been some discussion as to the most correct expression to be used in speaking of these cavities, the "Fasergrübchen" of the Germans. Thuret (Etudes Phyc. p. 32) speaks of them as "cryptes pilifères," and quotes in brackets "pores mucipares, Auct.," and "cryptostomates, Kütz."; while the terms "sterile conceptacle" and "neutral conceptacle" have been proposed by Prof. Bower. The term "sterile conceptacle" is open to objection as conveying an idea of abortive growth, and even "neutral conceptacle" has the same tendency. Prof. Bower says (Quart. Journ. Micr. Sci. vol. xx. p. 37), "Regarding the sexual conceptacle as the type of such structures, I have studied the development of it first, and then compared with it the development of the 'Fasergrübchen,' which I regard as an incomplete sexual conceptacle." Oltmanns, on the other hand, takes the view that the fertile conceptacles are "Fasergrübchen" which have in course of time come to produce the organs of reproduction (*l. c.* p. 82), and objects on this score to the term "neutral conceptacle." My own view of the matter is that the two forms of conceptacle are of equal antiquity, and were a later development in the ancestors of the Fucaceæ than the reproductive organs; therefore I consider neither form a development of the other, and the fact that one conceptacle contains reproductive organs, the other nothing but paraphyses, is an interesting point, but does not bear on the phylogenetic history of the conceptacles themselves. Following this theory, I propose to call the conceptacles which produce only paraphyses by the name of "vegetative conceptacles," as describing those cavities in the thallus which have been developed only in a vegetative direction. They are freely scattered over the whole thallus of *Turbinaria*, occurring on the roots, stem, petiole, and lamina. Their mode of development in other Fucaceæ has been minutely described by Prof. Bower (*l. c.*), Valiante (*l. c.* p. 11); and Oltmanns (*l. c.* p. 82), after referring to Bower's investigations, adds the fact that the further changes of the initial cell may take place in one of three different ways. In *Himanthalia* it disappears altogether; in *Halidrys* the upper part only disappears, while the middle part forms a hair, and the basal cells take part in the formation of the base of the conceptacle. In *Ascophyllum* the initial cell is persistent as a whole, and grows out into the conceptacle, divides up, and gives rise to a kind of placenta, which bears the sexual organs. In the case of the vegetative conceptacles of *Turbinaria* I have so far traced their development as to be able to place them in the division of which *Ascophyllum* is the type, in so far as the persistence of the initial cell is concerned; the initial cell divides longitudinally, and both cells, after again dividing transversely near the top, grow out into hairs, the upper division of the initial cell forming the swollen base of the mature filament (Pl. LV. figs. 4, 5, 6). These filaments fill the fully-grown conceptacle, and for some time I was uncertain whether they were a part of the plant or some parasite alga; however, developmental stages prove conclusively the continuity of the filaments with the tissue of the thallus. It is difficult to decide their exact length, since the hyaline end is often broken off in cutting the section. In comparing the vegetative conceptacle of *Turbinaria* with that of *Cystoseira* as figured by Dodel-Port (*l. c.* tab. 4. figs. 5 & 6), the resemblance between the two is marked (*cf.* Pl. LV. fig. 3), but there is a difference in the mode of growth of the paraphyses themselves, inasmuch as the upper cells of those in *Cystoseira* are very short, showing acropetal growth (*l. c.* tab. 5. fig. 3); while in *Turbinaria* the case is reversed and the growth is basipetal. The cells lining the sides of the mature conceptacle form a papillate layer protruding into the cavity, and resembling the cells lining the air-vesicle. (*Cf.* Pl. LV. figs. 2 & 3.)

III. *Root.*—The root is differentiated into three layers of tissue, and resembles in structure the base of the petiole near the point of its junction with the main stem. The cortical parenchyma, which is very thin-walled, occupies a large proportion of the whole, and the same pits are found in the central strand as those described in the stem and petiole.

Reproductive Organs.

The receptacles of *Turbinaria* are in all cases branched and more or less corymbose. They arise from the base of the petiole, and, as I have before mentioned, *Turbinaria* resembles in this respect the neighbouring genera *Sargassum* &c., where the receptacles grow indiscriminately on the stalk of the leaf or the vesicle. The growth of the receptacle, which resembles in form that of other Fucaceous algæ (Pl. LV. fig. 7), is by means of a pyramidal, more or less truncated apical cell, lying at the base of a depression, the narrow end being uppermost. A comparison of my own figures (Pl. LV. fig. 8 *a* & *b*) with that of Oltmanns (*loc. cit.* tab. xi. fig. 7) shows a certain resemblance between the apical cells of *Turbinaria* and *Halidrys*. In the case of *Turbinaria* it divides tangentially by walls parallel to its three sides, giving off daughter-cells, which form the epidermal layer, and these cells, by subsequent periclinal division at their base, cut off others which form the cortical parenchyma (Pl. LV. fig. 8*a*). Segments are also cut off by walls parallel to the base of the apical cell, which form the central conducting tissue. This tissue branches from the petiole of the leaf into the receptacles, and runs through the centre up to the apex; the cortical parenchyma and the epidermis are also continuous from the one into the other. The development of the fertile conceptacle I take to be the same as that of the vegetative conceptacle, which I have mentioned above.

As regards the species I have examined, I find that the conceptacles of *Turbinaria ornata*, J. Ag., contain only oogonia, together with branched paraphyses, which, however, bear no antheridia; *T. conoides* is both hermaphrodite and diœcious, resembling in this respect *Fucus ceranoides*, L.; and *T. trialata* is a diœcious species, of which I have only found the oogonia. The material of *T. Murrayana* at my disposal is not in good enough condition to enable me to decide anything definitely with regard to its reproductive organs; but, since I have found traces of oogonia in the conceptacles and nothing that argues in any way the presence of antheridia, I am inclined to regard it as another diœcious species. Thus, of the three species of which it is possible to speak decidedly, two are diœcious and one hermaphrodite and diœcious, while no species has as yet proved to be monœcious.

Antheridia.—The antheridia grow on comparatively thick branched hairs, and since they are often found growing out near the base of these hairs (*cf.* Thuret, Etudes Phyc. tab. xxi. fig. 5), which have themselves hardly reached the height of the antheridia, the conceptacle has the appearance of being lined with antheridia, seated each on a separate stalk (Pl. LV. fig. 10). It is on this account, and because the hairs rarely bear more than two or three antheridia, that it is difficult in any but the oldest conceptacles to be assured of the fact that the antheridia of *Turbinaria*, like those of all other Fucaceous algæ, grow on branched hairs, and an empty one is sometimes difficult to distinguish from the hyaline branch of the hair which bears it. In some cases the nuclei are very plainly visible (Pl. LV. fig. 10 *a*).

Oogonia.—I have been unfortunately prevented from tracing the development of the oogonia through want of good material for the subject, since in all the receptacles which I have examined the oogonia have shrivelled so much that it is impossible to make out more of their structure than the fact that they contain only one oospore; but, as I am hoping, through the kindness of Mr. Thurston, of Madras, to receive material more suited for the investigation of the conceptacles, I may be able at some future time to furnish a description of the oogonia of this genus.

Paraphyses.—Besides the branched hairs which bear the antheridia, there are unbranched paraphyses in the fertile conceptacles exactly resembling those in the vegetative conceptacles described above; and since in the latter case these filaments arise as outgrowths of the cells lining the base of the cavity, I assume that the development of these unbranched paraphyses takes place in the same manner.

Finally, I have to thank the Department of Science and Art for its kind permission to work in the laboratory at South Kensington, and I am specially indebted to Dr. Scott for his guidance and help throughout the morphological part of this investigation. For material I am indebted to the British Museum and to Madame Weber van Bosse; and personally to Mr. Murray, who has kindly revised the systematic portion and assisted me in determining new species. Mr. Batters has helped me to decide as to the nature of the filaments in the vegetative conceptacle.

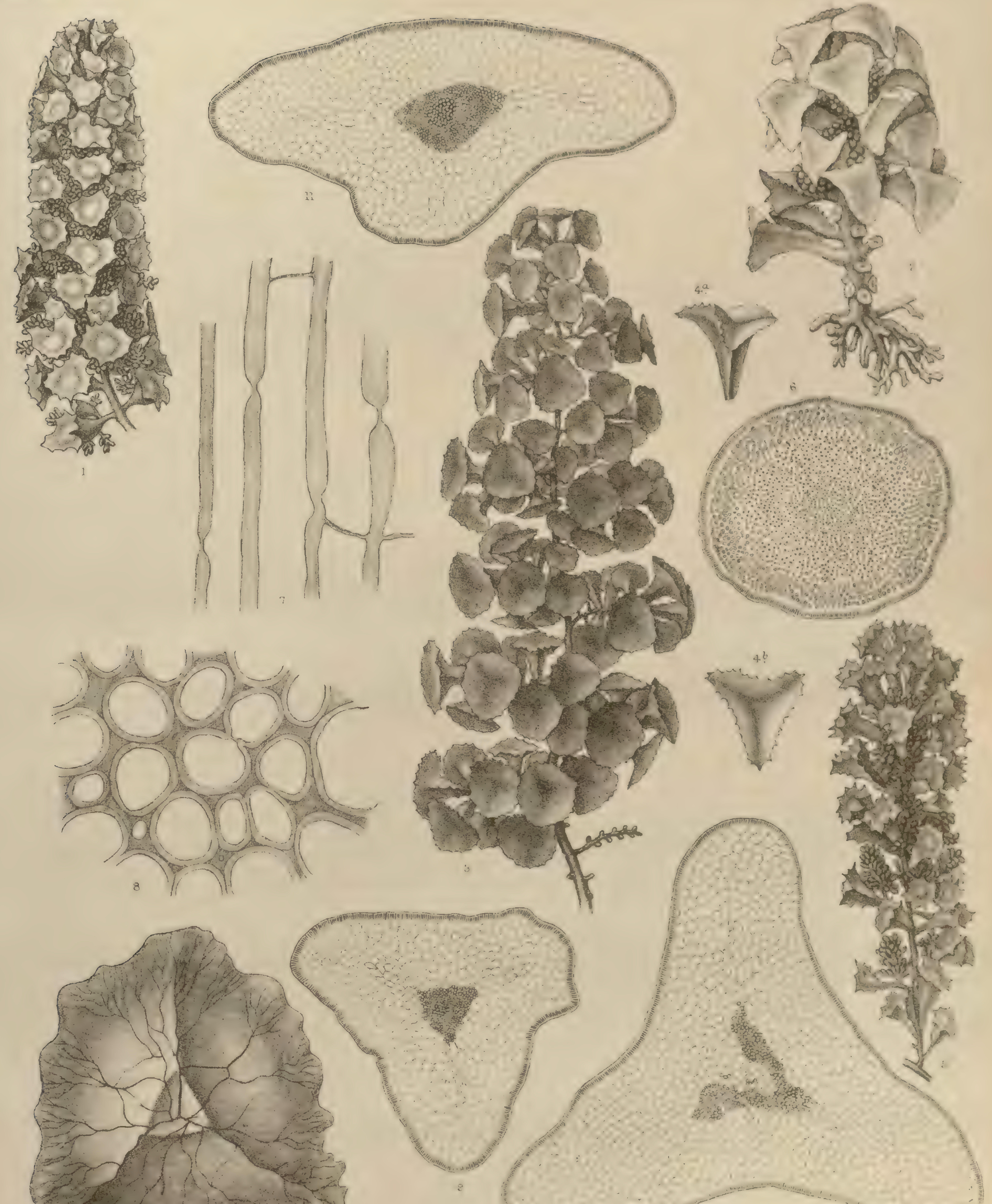
DESCRIPTION OF THE PLATES.

PLATE LIV.

Fig. 1. Branch of *Turbinaria conoides,* Kütz. Nat. size.
2. *T. Murrayana.* Entire plant. Nat. size.
3. *T. tricostata.* Branch. Nat. size.
4. Leaf of *T. tricostata,* var. *Weberæ.* Nat. size.
5. Branch of *T. dentata.* Nat. size.
6. Stem (transverse section) of *T. conoides.* × 28.
7. *T. conoides.* Cells of central strand. Long. sect. × 133 & 580.
8. „ „ „ Trans. sect. × 580.
9. „ Trans. sect. of petiole. × 28.
10. „ Diagram of the course of bundles up the wall of the vesicle and extending to margin of lamina. × 6.
11. *T. ornata.* Trans. sect. of petiole near the base. × 28.
12. „ „ „ halfway up. × 28.

PLATE LV.

Fig. 1. *T. conoides.* Meristematic layer lining air-vesicle. × 133.
2. „ Papillate layer lining mature air-vesicle. × 133.
3. „ Vegetative conceptacle. × 133.
4. „ Young vegetative conceptacle, I. × 580.
5. „ „ „ II. × 580.
6. „ Mature filaments of vegetative conceptacle. × 580.
7. *T. ornata.* Long. sect. of receptacle. × 28.
8. *T. conoides.* Apex of receptacle. Long. sect. *a* & *b.* × 580.
9. „ „ „ Trans. sect. × 580.
10. „ Antheridia. *a*-nuclei. × 580.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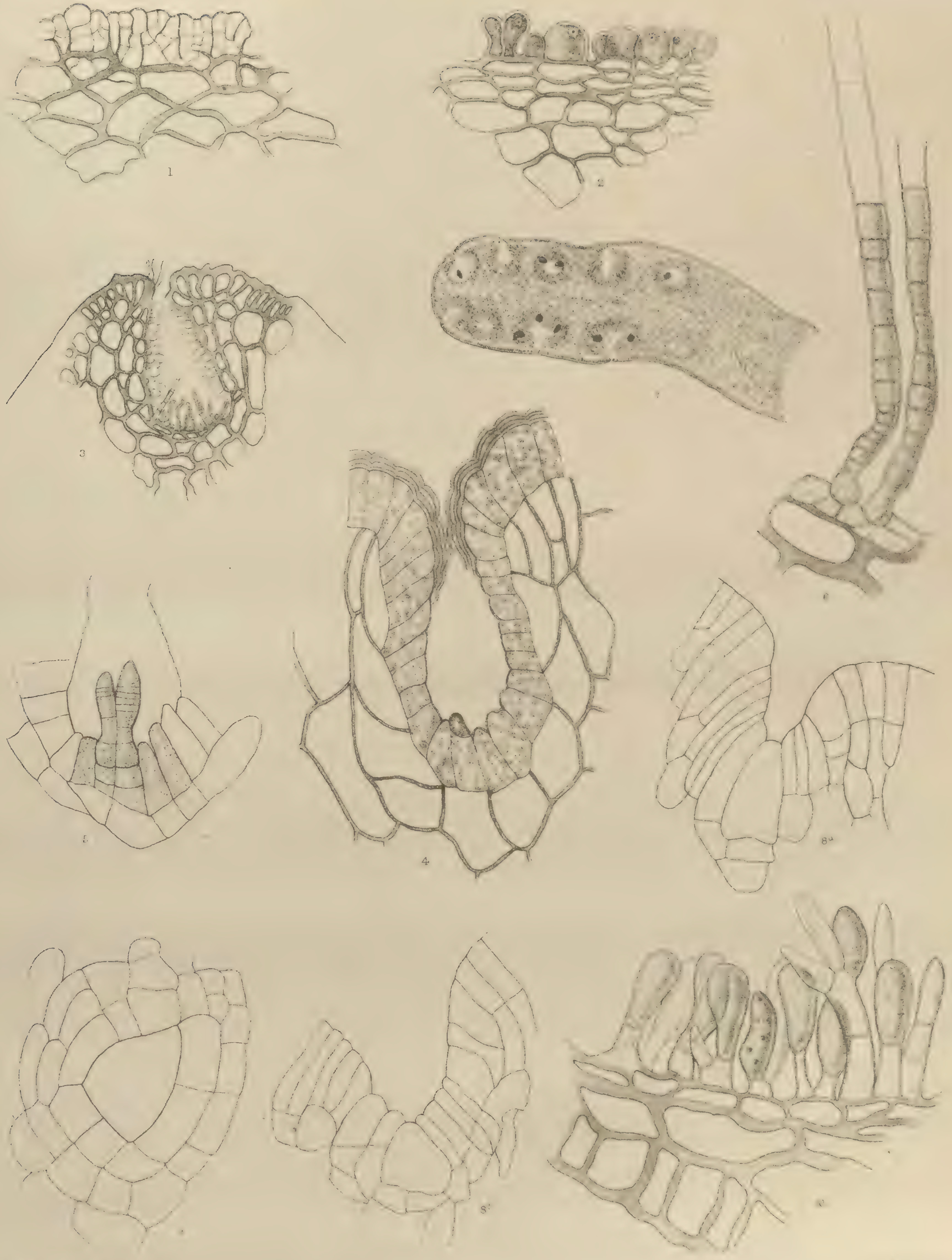
E. S. Barton del. Highley lith.

West, Newman, imp.

STRUCTURE OF THE GENUS TURBINARIA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	Part XIV.	1885.	0	6	0	0	4	6
	Part XV.	1885.	0	4	6	0	3	6
	Part XVI.	1885.	0	5	0	0	3	9
	Part XVII.	1886.	0	3	0	0	2	3
	Part XVIII.	1888.	0	2	6	0	2	0
III.	Part I.	1884.	1	14	0	1	5	6
	Part II.	1884.	1	12	0	1	4	0
	Part III.	1885.	1	10	0	1	2	6
	Part IV.	1885.	0	8	0	0	6	0
	Part V.	1887.	0	8	0	0	6	0
	Part VI.	1888.	0	6	0	0	4	6
IV.	Part I.	1886.	1	4	0	0	18	0
	Part II.	1887.	1	8	0	1	1	0
	Part III.	1888.	0	16	0	0	12	0
V.	Part I.	1888.	0	12	0	0	9	0
	Part II.	1888.	0	5	0	0	3	9
	Part III.	1889.	1	7	0	1	0	0
	Part IV.	1890.	0	12	0	0	9	0
	Part V.	1890.	0	6	0	0	4	6
	Part VI.	1891.	0	12	0	0	9	0
	Part VII.	1891.	0	6	0	0	4	6

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	Part IV.	1891.	0	6	0	0	4	6
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2nd Ser. BOTANY.] [VOL. III. PART 6.

THE

TRANSACTIONS

OF

THE LINNEAN SOCIETY OF LONDON.

ON THE LIFE-HISTORY OF PUCCINIA CORONATA, VAR. HIMALAYENSIS,

AND

ON THE LIFE-HISTORY OF PUCCINIA JASMINI-CHRYSOPOGONIS.

BY

A. BARCLAY, M.B., F.L.S., Bengal Medical Service.

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December 1891.

VI. *On the Life-history of* Puccinia coronata, *var.* himalensis.

By A. Barclay, *M.B., F.L.S., Bengal Medical Service.*

(Plate LVI. figs. 1–13.)

Read 16th April, 1891.

Introduction.

In the first part of my "Descriptive List of the Simla *Uredineæ*"* I described the æcidial stage of this fungus on *Rhamnus dahuricus*, Pall., and later, in the second part †, the uredo and teleutosporic stages on *Brachypodium sylvaticum*, Beauv., and on *Piptatherum holciforme*, Roem. & Schult. In the latter communication I incorrectly named the last-mentioned host *Chrysopogon cœruleus*, Nees; and at the time of writing was not aware that *Festuca gigantea*, Vill., also harboured the same teleutospore. In the former paper I also noted the probable generic relationship between these; but at that time I had not had opportunities for establishing the connection, and, indeed, the few inoculation experiments I had made were without result. Since then, however, I have devoted more time and attention to its life-history, and have been able to confirm the suspected relationship. The discovery of this relationship was indeed to be expected with confidence; and the investigation would scarcely have been worth undertaking were it not that my first inoculations failed, and that there existed two macroscopically very distinct forms of teleutospore, though microscopically alike (Pl. LVI. figs. 2 and 3). These two considerations stimulated me to work at the life-history. My first failures at inoculation made me suspect that the *Puccinia coronata* I found here might not run a parallel course with that at home; and I thought that, even if one form did, the other would certainly be different.

Æcidial Stage.—The æcidium is not widely diffused, though it is fairly common in certain localities. Ripe æcidia may be found as early as the latter part of May; but they are much commoner in July, *i. e.* in very moist weather. Individual shrubs may sometimes be seen largely attacked; but as a rule only a few insignificant leaf-patches are met with. The leaf-blades are the most frequent sites of attack; but the small stems are also more or less frequently assailed. In my original description of this stage of the fungus ‡ I noted also that the drupes were infested, and sometimes extensively so. I formerly described the fungus, as it is seen on the leaves of *Rhamnus*, thus:—"When the leaf is attacked the invaded areas are usually small, and generally only one patch occurs on each leaf." (But I would here add that occasionally a single leaf may bear numerous patches.) "These patches are dark reddish-brown above, surrounded by a halo of pale yellow, and the orange-yellow æcidia are borne on the lower, or concave, surface of the leaf, opposite the dark central part seen above. The red colour of the patch is due especially to discoloration in the palisade-cells, and the abnormal thickness to hypertrophy of the spongy tissue, the palisade-cells retaining their normal dimensions and characters. The tissues in the areas invaded are very extensively permeated by hyphæ, and many cells are destroyed. While the thickness of the leaf-blade is normally about 0·144 mm., it is about 0·55 mm. in patches bearing ripe æcidia. A patch of ordinary size measured 1 cm. in total diameter, the central reddish-brown part measuring 6 mm. in diameter. The patches are sometimes considerably larger, however, and more irregular in shape. The æcidia are tubular structures, very deeply sunk into the laminal tissue, measuring about 2 mm. in length, and therefore resembling in some degree the æcidium on *Pyrus Pashia* *. With very few exceptions the æcidia burst from the lower surface of the leaf. These patches on the leaves are often placed near the margin, and are usually between and not over the principal veins; but when a vein is involved it is considerably thickened. When the stem is attacked, which occurs but rarely, it is considerably swollen."

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* Journal of the Asiatic Society of Bengal, vol. lvi. pt. ii. no. 3 (1887).

† *Ibid.* vol. lviii. pt. ii. no. 2 (1889).

‡ *Loc. cit.*

I should here add that only the earlier peridia are long and tubular, *i. e.* those produced before the very wet weather sets in, after this the peridia are always very short; I believe the difference is due purely to an effect of climate. Shrubs that I have inoculated with material from the same source in my garden outside bore both forms of peridia in their proper seasons. Mr. J. H. Lace, of the Forest Department, sent me some specimens from the interior of the Himalayas, gathered in July, with long peridia, whilst in Simla at that time they were all short-tubed. But the former region is beyond the influence of the south-west monsoon, and is therefore dry in July, whilst in Simla it is excessively moist.

Teleutosporic Stage.—With regard next to the general characters of the uredo and teleutospore stage of the fungus on *Brachypodium sylvaticum* and *Piptatherum holciforme* and *Festuca gigantea*, there are two points of particular interest. The teleutospores on *Brachypodium* are minute black isolated points on the upper surface of the leaf-blade, and are always naked, *i. e.* not covered by the epidermis of the host; whilst those on the latter two hosts are shortly linear, on the lower blade-surface, and characteristically covered by the epidermis. But though the epidermis covers the spore-bed, there is often a longitudinal split through the covering skin, and thus the spore-bed below may be seen with a field-lens. These marked differences induced me to suspect strongly that the latter belonged to a distinct species, though I provisionally coupled them with the fungus on *Brachypodium* under the name *Puccinia coronata*, Corda. The other feature of interest is that uredo pustules are found frequently on *Piptatherum* and *Festuca* throughout winter in sheltered places, and in early spring on the newly-unfolded blades, long before *Rhamnus* bears any leaves. These could not, therefore, have been produced by æcidiospores; and I suspected either that a continuous reproduction of uredospores occurred throughout the year (an improbable hypothesis) or that the mycelium persisted in the root, though I could not detect any hyphæ by microscopic examination. Early in the spring of this year (1890) I uprooted a plant with dried leaves bearing numerous teleutospore pustules and kept it in my laboratory with its roots in water, changing the water frequently. It unfolded new green leaves shortly afterwards, and on the 17th of May I found several uredo pustules on one of them, proving almost conclusively that the mycelium is perennial. In the case of *Brachypodium* I do not think the same condition exists, as it is rare to find uredospores on it until the æcidia of *Rhamnus* are ripe. I did, however, one year find in one locality, in nature, several leaves of what I thought was *Brachypodium* bearing uredospores as early as the 29th of March. It is possible, however, that I was mistaken in my identification of the host, a somewhat difficult matter in Grasses before flowering; but the spores were fairly characteristic. The only other explanation I can offer is that they were produced by uredospores from *Piptatherum*. Had the mycelium been perennial in *Brachypodium*, I must have observed uredo pustules on the leaves as frequently as I did on *Piptatherum*.

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* This fungus I subsequently described more fully in 'Scientific Memoirs by Medical Officers of the Army of India,' Part v. 1890, under the name *Gymnosporangium Cunninghamianum.*

I would here also draw attention to another remarkable peculiarity of this fungus, and that is the long time during which the uredospores of *Piptatherum* and *Festuca* retain vitality and capability of germination under favourable conditions. I collected some leaves, which were just beginning to wither, on the 16th of January, and these contained numerous teleutospore pustules, but also a few uredo pustules. These leaves were cut up into small pieces, and kept in a glass beaker covered over loosely with a large watch-glass. On the 2nd June, *i. e.* 4½ months later, I scraped off spores and floated them on water and kept them in a moist atmosphere. After 24 hours the uredospores had germinated most freely, although the teleutospores had not. I shall recur to this subject later; meanwhile I proceed to a systematic description of the fungus.

I. ÆCIDIUM.

a. *Spermogonia.*—These are not very numerous, and precede the æcidia by a considerable interval; they are formed on already highly-hypertrophied parts, in which the mycelial filaments contain orange-red oil-globules. The normal thickness of the leaf-blade being 0·144 mm., the parts bearing spermogonia are about 0·550. The spermogonia are both epi- and hypophyllous, but oftener epiphyllous. They are deeply set, measure about 0·107 mm. in depth and breadth, and have tufts of protruding paraphyses.

b. *Peridium.*—The peridial tube in dry weather is very long and cylindrical, measuring about 2 mm. in length by 0·5 mm. in diameter, and opening at the summit by frayed and everted edges. It consists of a single layer of cells, angular (4- to 6-sided), measuring 26×16 μ, containing orange-red oil-globules in the centre, and spiny. The peridia are hypophyllous and usually on a deeply concave surface.

c. *Æcidiospores.*—These are bright orange-red, round to oval, beset densely with fine tubercles, measuring about 23 μ in diameter when fresh and just wetted, but 31–19× 24–18 μ after being 24 hours in a moist atmosphere. They germinate readily in water, throwing out long, simple, unbranched tubes, into the distal ends of which wander the coloured spore-contents, leaving the spore-walls colourless or grey. The emptied spores are then seen, especially with staining, to possess six germ-pores.

II. UREDO.

A. On *Brachypodium sylvaticum.*—These pustules are somewhat larger than the teleutospore pustules as a rule. They are orange-red, circular, minute, isolated, very numerous, and epiphyllous. The spores are pale saffron-yellow or orange-yellow bodies (the coloured contents aggregated in the centre of the spore), round to oval, measuring 24–20×21–15 μ. The epispore is very finely tuberculated, and is pierced by 3 to 4 germ-pores. They germinate in the usual way, throwing out a single simple tube.

B. On *Piptatherum holciforme* and *Festuca gigantea.*—The pustules are shortly linear to round, orange-yellow, mostly epiphyllous, and several may often be seen on one discoloured patch extending right across the blade. The spores are round to oval, pale yellow or orange-yellow, with the coloured contents aggregated in the centre, echinulate, and measuring, when fresh, 28–22×22–20 μ. These uredospores are therefore considerably larger than those from *Brachypodium.* Each spore has 4 to 6 germ-pores. They germinate in the usual way, throwing out a single unbranched tube, in the distal end of which the coloured contents accumulate, leaving the spore-walls colourless.

III. TELEUTOSPORE.

A. On *Brachypodium sylvaticum.*—The pustules are minute black points on the upper leaf-surface and quite naked (Pl. LVI. fig. 3). The spores are brown, with the characteristic crown of usually regular processes, borne on short stalks. The spores narrow gradually towards the stalk, and are scarcely, if at all, constricted at the septum (Pl. LVI. figs. 8 and 9). They have a smooth epispore, and measure when fresh 44–38×11–10 μ (at the septum). They germinate only after a winter rest, and I have observed this from the end of March to August. The promycelium from the upper cell emerges from a point immediately under the crown, and that from the lower cell from near the septum. Four sporidia are usually formed by each at the ends of short pointed sterigmata. The sporidia are oval, and measure 13–10×9–6 μ (Pl. LVI. fig. 11).

B. On *Piptatherum holciforme* and *Festuca gigantea.*—The pustules are black, more or less completely covered by epidermis, linear, and hypophyllous (Pl. LVI. fig. 2). The spores are brown, crowned with processes, which are, however, generally more irregular than those above described, and borne on short stalks. The crown processes usually number five, but vary from one to six or seven (Pl. LVI. fig. 4). They do not narrow so regularly towards the stalk, and spores may frequently be found rounded in both cells and constricted at the septum (Pl. LVI. figs. 4 and 13). They are smooth externally, and measure 55–43×14–8 μ (septum). They germinate after a shorter rest, as I have seen them growing in my laboratory as early as the 15th February, when most other teleutospores still refused to do so. After germination the spore-walls remain chestnut-brown in colour. Four sporidia are formed by each promycelium, measuring 9×7 μ. They are pale orange-yellow and often form secondary sporidia. The fungus on this host is not unlike that described by Lagerheim as *P. gibberosa* *. Nor apparently is it unlike Plowright's *Puccinia Festucæ* in general characters; but as the only account of this fungus which I have seen is contained in a preliminary description in the 'Gardener's Chronicle' †, I cannot pursue the comparison further. Plowright's fungus must, however, be entirely different, since it is associated with *Æcidium Periclymeni*, Schum., and I have never seen an æcidium on any genus of the *Caprifoliaceæ* in this region.

The dimensions of the spores of the Indian variety are contrasted with those of the European in the following table:—

		Æcidiospores.	Uredospores.	Teleutospores.
European		26–17 × 21–13 μ.	28–19 × 21–16 μ; 3–4 pores.	60–35 × 21–12 μ.
Indian	*Brachypodium*	31–19 × 24–18 μ.	24–20 × 21–15 μ; 3–4 pores.	44–38 × 11–10 μ.
	Piptatherum		28–22 × 22–20 μ; 4–6 pores.	55–43 × 14–8 μ.

The æcidiospores of the Indian variety are larger than those of the European; the uredospores are much the same in size, but are not associated with paraphyses; and the teleutospores are decidedly smaller.

The European æcidium is known to occur on several species of *Rhamnus*, whilst in India, in the Simla region, it is known only on one of the four species prevalent. The uredo- and teleutospore stages in Europe are known to occur on several genera of Grasses, including *Festuca*; in India they are, so far, known only on three genera, though possibly future research may prove their occurrence on more.

Inoculation Experiments.—The teleutosporic stage on *Brachypodium* is apparently much commoner, and in nature is evidently much more clearly connected with æcidial production on *Rhamnus* than the teleutosporic stage on the other two hosts; for wherever I found the æcidium on *Rhamnus* I have usually found *Brachypodium* with teleutospores, though I have frequently, and indeed usually, missed *Piptatherum* and *Festuca*. The latter are, however, more difficult plants to recognize with certainty when only in leaf than *Brachypodium*.

(Exper. I.) I therefore commenced inoculation experiments with teleutospores from *Brachypodium*, and had my first positive result on the 4th July, 1889, on the leaves of a twig which I had cut off and placed in water, and on which I had placed sporidia on the 25th June. After laying on the sporidia I placed the twig in a glass gardener's-box outside, within which the air is always very moist. On the 4th July several leaves showed *very* numerous foci of attack with spermogonia. On the 24th July these leaves exhibited young æcidia.

I had no further opportunity of continuing these experiments that year, as the teleutospores refused to germinate any longer, but I resumed them this year (1890).

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* Bericht der Deutschen botanischen Gesellschaft, 1888, Bd. vi. Heft 3, p. 125.

† 'Gardener's Chronicle,' July 12th, 1890, p. 42.

(Exper. II.) I placed some teleutospores from some specimens of *Brachypodium* collected on the 16th January in water on the 10th April: on the 11th I noticed that free germination had taken place, with the production of numerous sporidia. I placed these on the leaves of a twig of *Rhamnus* under a glass shade in my laboratory. On the 16th (5 days) I noticed several foci of attack, though as yet there was no discoloration of the leaves, but only characteristeric upheaved spots. On the 19th (8 days) I counted 40 leaves on the twig inoculated, 21 of which were very distinctly attacked, as many as 12 distinct foci being observable on one leaf. On another twig, similarly treated, I counted 12 leaves, of which 6 were attacked. On the 30th both twigs began to wither without making any further progress, and the experiment came to an end.

(Exper. III.) Again, on the 7th May I inoculated a twig with sporidia derived from teleutospores collected on the 26th January, and put in water the preceding day (6th). On the 19th May (12 days) I counted 8 spermogonial spots on one leaf, and several spots on others; but unfortunately the twig began to wither and the experiment was closed. There were immense numbers of foci of attack on these leaves.

(Exper. IV.) On the 12th April, as a parallel experiment to that described in the preceding paragraph, I inoculated several leaves of a twig with sporidia of teleutospores from *Piptatherum* which had been 24 hours in water, and the twig was then put under a separate glass shade in my laboratory. On the 17th (5 days) several leaves showed decided spots of attack, which on the following day were yellow, bearing spermogonia. On the 19th (7 days) I counted 41 leaves on one twig, 7 of which were very distinctly attacked, the highest number of distinct foci on any single leaf being 5. Another twig had 10 leaves, 2 of which were attacked; and a third had 12 leaves, 3 of which were attacked. These twigs also withered before producing æcidia.

(Exper. V.) On the 23rd May I inoculated two separate twigs with the sporidia of *Piptatherum* or *Festuca* gathered on the 5th February, and put each under a separate glass shade. I purposely abstained from using any spores from *Brachypodium* for some days previously in order to avoid accidental contamination. One of these twigs (A) showed one spot of initial attack (distinct spot of upheaval) on the 30th, and on the following day two such spots: on the 14th these two spots were distinctly spermogonial; but there were also two other very distinct yellow spermogonial spots on each of two leaves (*i. e.* four spots in all), and one younger point of attack on a third leaf. Soon after this the twig began to wither, and the experiment was closed on the 21st. The other twig (B) showed three spermogonial spots on one leaf on the 6th of June; but the twig was attacked by aphides and became sickly in appearance, and the experiment was closed on the 14th.

(Exper. VI.) On the 16th June I inoculated a twig with the dry spores from *Piptatherum* or *Festuca* collected on the 5th February and kept it under a glass shade. One spermogonial patch was ultimately produced.

(Exper. VII.) On the 2nd July I inoculated some leaves with the sporidia of spores from *Piptatherum* collected on the 16th January, and on the 12th noticed four spots of attack in the spermogonial stage, all on one leaf. The teleutospores were now found to be very sluggish in germination, the season for natural attack having come nearly to a close.

(Exper. VIII.) I made only one experiment with a view to producing uredospore pustules with æcidiospores. On the 1st August I placed a pot containing *Brachypodium* under some twigs of *Rhamnus* with ripe æcidia in a gardener's box, and on the 17th found the leaves covered with uredo pustules.

From this account of my experimental inoculations, it will be observed that attack by the sporidia of spores from *Piptatherum* and *Festuca* was in all cases less vigorous than with the spores from *Brachypodium.* From the beginning, after my first successful experiment, I had no doubt about the generic relationship between the *Rhamnus* æcidium and the teleutospores on *Brachypodium*; but I felt less certain about the connection of the parasite on *Piptatherum* and *Festuca.*

At first I feared that there might have been accidental contamination of my *Piptatherum* and *Festuca* material with spores from *Brachypodium*, and this is the reason why the experiments with the former more numerous. My subsequent experiments convinced me that the fungus on *Piptatherum* and *Festuca* is really capable of producing the æcidium on *Rhamnus.* The difference in the vigour of attack is, however, noteworthy, and suggests the possibility that it may give rise more easily to some other æcidium on some other host.

GENERAL REMARKS.

Dr. P. Dietel, of Leipzig, to whom I sent specimens of the æcidium on *Rhamnus* and teleutospores on *Brachypodium*, and to whom I am indebted for kindly criticism, informed me that both differed in habit from the European species. I could not myself detect any striking difference of habit in the æcidium (*i. e.* the form with short peridia) on comparing it with a specimen of the European *Rhamnus* æcidium he sent me in return; but the specimen was small, and I am not familiar with the appearance of the European form. The difference in habit of the teleutospore pustules on *Brachypodium* is, however, very striking; and I have already alluded to the naked, small, circular, epiphyllous pustules, in contrast with the covered, linear, hypophyllous pustules at home. When I sent specimens of the teleutospore on *Brachypodium* to Dr. Dietel I did not know, and did not suspect, that the similar spores borne by *Piptatherum* and *Festuca* were biologically the same. The habit of the fungus on these two hosts corresponds closely with that of *Puccinia coronata* in Europe, so far as I can make out from written descriptions. We have therefore here the interesting fact disclosed that such striking differences of habit need not be associated with specific differences. The interest of this discovery lies especially in its application to the rusts and mildews of cereal crops. *Puccinia Graminis* differs markedly from *P. Rubigo-vera* and *P. coronata* in the teleutospore pustules being naked, whilst in the latter they are covered; and Mr. T. J. Burrill writes of *P. coronata*, Corda :—"This species is certainly closely related to *P. Rubigo-vera.* Indeed it is scarcely possible to separate them, except by the terminal projections of the teleutospores in *P. coronata*, and these are present in varying degrees, sometimes nearly wanting." * The interest of this is very great both in the United States and in India, so far as I am yet acquainted with the facts. Mr. H. L. Bolley writes that *Puccinia Rubigo-vera* is undoubtedly the most prevalent form of rust on wheat in Indiana, but there an æcidium occurs on *Cynoglossum officinale* *. In India there is no doubt that *P. Rubigo-vera* is also the most common (and very abundant) cause of rust on wheat and barley; but here no æcidium is known on any Borage. I asked my friend Dr. D. Prain, of the Royal Botanic Garden, Calcutta, to look through the whole collection of *Boragineæ* in the Herbarium there, as I thought that in so large a collection some specimens might be found attacked by an æcidium. This he most kindly did, and wrote as follows:—"I have gone over the whole of the Order carefully at two different times, and I cannot find a suspicious-looking specimen in any of the herbaceous species." Even in Simla, as I have elsewhere † pointed out, where a Barberry æcidium is common, I have never seen *P. Graminis* on any cereal crop, whilst *P. Rubigo-vera* is very abundant and destructive; and despite the most careful search I have never yet succeeded in finding an æcidium on any species of the *Boragineæ*. It would exceed the limits of this paper were I to enter more fully into this side issue of my subject; but I will add that, whilst I have never found *P. Graminis* on any cereal crop here, I have found a teleutospore resembling *P. Graminis* on a wild grass, probably *Brachypodium distachyum*, Roem. & Schult., and have artificially reproduced the spermogonial stage of an æcidium on *Berberis Lycium*, Royle, with it. But my investigations into this matter are still incomplete. I have several times applied the sporidia of *P. coronata*, especially from *Piptatherum* and *Festuca*, to the leaves of *Berberis Lycium* and *B. aristata*, DC., but without result.

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* Bulletin of the Illinois State Laboratory of Natural History, vol. ii. art. 3. "Parasitic Fungi of Illinois," pt. i., 1885.

Before concluding I would draw attention to the remarkably long retained vitality of some uredospores in this region. I have noted above the power of ready germination of the uredospores from *Piptatherum* four and a half months after keeping. This is, however, by no means an isolated case. I first drew attention to this peculiarity in my "Descriptive List of the Simla *Uredineæ*," in describing *Puccinia Galii*, Pers., when I wrote:—"A curious feature about these uredospores is the comparatively long time they retained their vitality. In a cultivation of teleutospores from material collected in October, and set in water on the 26th March following, all the uredospores present, of which there were several, germinated in 24 hours, whilst the teleutospores remained *in statu quo*" ‡. Since then I have observed the same thing in the following species:—

1. *Uredo Bupleuri*, mihi, collected 2nd October, germinated 14th June, *i. e.* 8 months and 12 days after.

2. *Uredo Gomphrenatis*, mihi, collected 7th November, germinated freely 14th June, *i. e.* 7 months and 7 days after.

3. *Puccinia Prenanthis*, Pers., collected 31st October, germinated (a few) 14th June, *i. e.* 7 months and 6 days after.

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* Bulletin of the Agricultural Experiment Station of Indiana (Purdue University), "Wheat Rust," July 1889.

† Journal of the Royal Agricultural Society, London.

‡ Journal of the Asiatic Society of Bengal, vol. lviii. pt. ii. No. 2 (1889).

4. *Puccinia Caricis-filicinæ*, mihi, collected 24th November, germinated 6th May, *i. e.* 5 months and 12 days after.

5. *Uromyces Vossiæ*, mihi, collected on dried over-wintered leaves in nature, germinated freely in April, probably about 5 months after ripening.

6. *Puccinia Acetosæ*, Schum., collected 6th December, germinated freely 23rd March, *i. e.* 3 months and 17 days after.

7. *Uromyces Pisi*, Pers. (from *Lathyrus sativus*), collected 4th April, germinated 19th June, *i. e.* 2 months and 15 days after.

8. *Melampsora Lini*, Pers., collected 4th April, germinated 19th June, *i. e.* 2 months and 15 days after.

9. *Puccinia Flosculosorum*, Alb. et Schw., collected 26th December, germinated freely on 12th March, *i. e.* 2 months and 17 days after.

I shall conclude by again drawing attention to the similarity this fungus in the æcidial stage exhibits to the æcidial stage of *Gymnosporangium*, *i. e.* in the long interval which elapses between the eruption of spermogonia and the formation of æcidia, and in the very deep-seated position of the basidial layer. These points are not in themselves of any real importance, but they serve to strengthen the view I had been led to form gradually from other considerations that the distinction between *Gymnosporangium* and *Puccinia* is not of generic value. The chief characters of *Gymnosporangium* upon which its generic distinction is based are :—

(*a*) The gelatinous nature of the stalks of the teleutospores;
(*b*) The displacement of the germ-pore of the upper cell of the teleutospore from the apex to near the septum;
(*c*) The plurality of germ-pores to each cell of the teleutospore;
(*d*) The absence of uredospores; and
(*e*) The peculiar characters of the æcidial fructification, *i. e.* the length of the peridial tubes, the depth to which they penetrate within the lamina of the leaf, and the long interval between the production of the spermogonia and the æcidia.

With reference to (*a*), I have myself shown elsewhere * that a gelatinous sheath to the stalks of the teleutospores is not peculiar to *Gymnosporangium*, occurring as it does (though to a minor extent) in *Puccinia Prainiana*, mihi (*Cæoma Smilacis*, Barclay), and as De Bary has also depicted in the case of *P. Berberidis*, Montagne †.

With regard to (*b*), although I know of no *Puccinia* which shows a displacement of the germ-pore of the upper cell downwards, yet I have met with two species in which this occurs in the lower cell, namely in *Puccinia Geranii-sylvatici*, P. Karst., var. *himalayensis*, and *P. Wattiana*, mihi ‡, on *Clematis Gauriana*, Roxb.

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* 'Scientific Memoirs by Medical Officers of the Army of India,' Part iv. 1889, & Part vi. about to be issued.

† Botanische Zeitung, No. 48 of 1879, p. 846.

‡ Journal of the Asiatic Society of Bengal, vol. lix. (1890) pt. ii. no. 2.

With regard to (*c*), *Gymnosporangium* still remains alone, so far as I am aware, in having more than one germ-pore to each cell of the teleutospore.

With regard to (*d*), the absence of uredospores, this peculiarity is of course not rare, and I have noted a remarkably striking instance in *Uromyces Cunninghamianus* (Linn. Trans. *ante*, p. 141).

With regard to (*e*), the subject of this paper shows that it also is not peculiar to *Gymnosporangium*.

Thus, of all the peculiarities I have noted, the plurality of germ-pores is alone entirely peculiar to *Gymnosporangium*.

DESCRIPTION OF PLATE LVI. Figs. 1–13.

Fig. 1. From photograph of *Rhamnus* bearing æcidia on stem and leaves, and with short peridia. Natural size.

Fig. 2. Portions of leaves of *Piptatherum holciforme* and *Festuca gigantea*, showing hypophyllous teleutospore pustules, linear, and more or less covered by epidermis. Slightly enlarged.

Fig. 3. Portions of leaves of *Brachypodium sylvaticum*, showing epiphyllous teleutospore pustules, circular, discrete and naked. Slightly enlarged.

Fig. 4. Teleutospores of various shapes from *Piptatherum*. × 350.

Fig. 5. Peridial cells and æcidiospores from a specimen obtained from Europe (Dr. Dietel), to compare with figs. 6 and 7. × 350.

Fig. 6. Peridial cells of Himalayan variety. × 350.

Fig. 7. Some detached peridial cells and æcidiospores, to compare with fig. 5. × 350.

Fig. 8. Teleutospore and uredospore from *Brachypodium sylvaticum*. × 350.

Fig. 9. Teleutospore from same. × 350.

Fig. 10. Teleutospore with promycelium, from *Brachypodium*. × 350.

Fig. 11. Sporidia from same. × 350.

Fig. 12. Teleutospores from *Piptatherum holciforme*. × 350.

Fig. 13. Teleutospores and uredospores from *Festuca gigantea*. × 350.

VII. *On the Life-History of* Puccinia Jasmini-Chrysopogonis, *nov. sp.*

By A. Barclay, *M.B., F.L.S., Bengal Medical Service.*

(Plate LVI. figs. 14–23.)

Read 16th April, 1891.

In a recent paper on the life-history of an æcidium on *Jasminum grandiflorum* I alluded to the existence of an æcidium on another species of Jasmine, namely *J. humile*, L., and drew attention to the remarkable attitude of our three Jasmines towards the Uredineæ. Whilst *J. grandiflorum*, L., alone of these will harbour *Uromyces Cunninghamianus*, *J. humile* only will bear the æcidium I am about to describe, and *J. officinale*, L., will not suffer itself to be attacked by either. And again, while the æcidium on *J. grandiflorum* is an autœcious species, that on *J. humile* is heterœcious, the other host being a grass, *Chrysopogon Gryllus*, L. The parasite on *J. grandiflorum* exhibited several very anomalous peculiarities, but the only feature of peculiar interest in the species I am about to describe is the extraordinary abundance and wide distribution of the teleutosporic stage as compared with the comparative scarcity of the æcidial stage. This disproportion in the distribution of the two stages I noted in my Descriptive List of the Simla Uredineæ *, long before I knew that they were related to one another. And, indeed, this peculiarity misled me in my long-continued attempt to discover the life-history of the æcidium, for so abundantly distributed a teleutospore I felt sure must be related to one of our more abundant æcidia. I was at last led to suspect the relationship, with, however, little hope that the suspicion was well founded, by observing last autumn that the grass was largely attacked close to a bush of Jasmine which I had previously noticed had been unusually largely attacked by the æcidium. Before, however, going on to a description of the experiments I made to establish the relationship I will shortly describe the systematic characters of the fungus.

ÆCIDIAL STAGE.

This stage of the parasite makes its appearance at the commencement of July, shortly after the monsoon rains have set in, *i.e.* during very moist weather, and continues to be met with throughout July and August. The æcidium is very conspicuous (Pl. LVI. fig. 14), the mycelium giving rise to large circular or irregularly circular patches on the leaf-blades, usually about 8 millim. to 1 centim. in diameter, reddish brown with a halo of yellow above, and the same below before the æcidia have made their appearance, but a little lighter in colour, especially the yellow halo. These attacked areas of the leaf-blade are somewhat thickened. The petioles are also frequently attacked, when they become brown in colour and thickened. The stem is sometimes, but not often, attacked. In this case the whole stem is uniformly enlarged; and the largest stem-hypertrophy I saw was 1·5 centim. in length by 4 millim. in diameter.

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* *Æcidium Jasmini*, in Journal of Asiatic Society of Bengal, vol. lvi. pt. ii. no. 3, 1887, p. 366; and *Puccinia Chrysopogi*, in the same Journal, vol. lviii. pt. ii. no. 2, 1889, p. 247.

The *spermogonia* are of the usual character, but sometimes irregular in shape (fig. 23), and are formed only on the upper leaf-surface. They precede the eruption of the æcidia by a very short interval; and, indeed, I have often seen ripe spermogonia on the upper leaf-surface whilst the lower surface bore young, still unopened peridia. They are deeply set, their bases reaching down to the inner level of the palisade-cells. They measure about 126 μ in depth by 157 μ in breadth, and have a tuft of paraphyses protruding about 63 μ from the mouth.

The *æcidia* burst always from under a leaf-surface. They contain very brilliant orange-red spores, and are deeply sunk within the laminal tissue, their bases resting often on the inner ends of the palisade-cells (Pl. LVI. fig. 22).

The *peridia* are very short tubes, densely packed together, bursting at the summits in a stellate manner. The tube consists of a single layer of flat cells, more or less hexagonal, and measuring about 26 × 22 μ (Pl. LVI. figs. 19 & 20, *b*). These cells are thick-walled, and contain orange-red oil-globules in their cavities. They are arranged in an imbricate fashion, the upper end of each cell overlapping the lower end of the cell above *internally* (Pl. LVI. fig. 22).

The *mycelium* is colourless and ramifies between the parenchyma-cells. The hyphæ are remarkably straight, and not so convoluted as usual. In the leaf-blade they are most numerous among the spongy cells, but twigs run up also between the palisade-cells to the upper epidermis-cells; and haustoria, in the shape of simple small tubular intrusions, are formed abundantly in the palisade- and upper epidermis-cells. The mycelium gives rise to hypertrophy of the spongy cells; but the palisade-cells retain their normal proportions and shape. In the stem mycelial filaments may be seen everywhere, but sparingly in the central pith-cells: here the mycelium is most abundant in the cortical parenchyma-cells, which are very considerably hypertrophied. Haustoria similar to those described above are met with in these cells.

The *æcidiospores* are of a very brilliant orange-red colour, oval, covered externally with shallow tubercles, and measure when fresh 26 × 20·2 μ on an average (Pl. LVI. fig. 20, *a*). They do not germinate readily in water, but when they do they throw out straight unbranched tubes with a decided tendency to spring up into the air instead of into the water. Into these tubes the brilliantly coloured contents of the spore wander. Each spore has from 7 to 8 germ-pores. The spores are turned deep blue by sulphuric acid.

TELEUTOSPORIC STAGE.

Uredospore pustules appear in July, when the æcidial stage is in existence. They are very brilliantly orange-red, mostly epiphyllous, but largely also hypophyllous. Pustules primarily break out from the upper leaf-surface, but afterwards the same mycelium produces pustules below also. They are round or slightly oval, and very numerous.

The spores are, like the æcidiospores, very brilliant in colour (orange-red). They do not germinate readily in water, but some always do, throwing out a single, long, twisted unbranched tube. They are also very large, measuring when fresh 33–23×26–23 μ, or on an average 28·7×26·5 μ. When scraped off they often retain a portion of the stalk (Pl. LVI. fig. 21). They are sparsely spiny and contain an indefinite number of germ-pores. There are no paraphyses.

The *teleutospore* pustules are well raised, deeply convex, plump, oval or broadly linear, and dark brown. They are both epi- and hypophyllous, but oftener epiphyllous. The spores are oval, and well rounded at both ends, slightly constricted at the septum, and very thick-walled (fig. 15). There is little or no special thickening at the free end. They are firmly adherent, and when scraped off retain a portion of stalk. They are dark brown, smooth on the surface, and measure 43×24 μ at the septum. A clear nuclear vesicle is visible in each cell. Young teleutospores are often seen in fully developed uredo pustules. They germinate only after a winter rest. After lying 24 hours in water it will be seen that they have thrown out promycelia—one from a point near the apex of the spore, and the other from a point near the septum (Pl. LVI. fig. 15), into the distal ends of which the orange-red contents of the spore wander, leaving the spore-walls still deep brown. The end then divides into four compartments, each producing a sporidium at the end of a short pointed sterigma (Pl. LVI. fig. 16). But frequently and very characteristically, after the promycelium has divided into four parts, the sterigmata form uncommonly long tubes, usually much twisted (Pl. LVI. fig. 18, *a*, *b*). In such cases they do not form sporidia. I do not know whether a similar growth occurs in nature, but if it does the sterigmatous tube must attack directly without the intervention of a sporidium. This curiously abnormal formation of sterigmata is by no means uncommon, and, indeed, in water-cultivations it is as common as the more normal course sketched above. The sporidium is large, oval, and coloured, and frequently emits a germ-tube before it is detached from the sterigma. The germ-tube is usually characteristically spiral, and rarely straight (Pl. LVI. fig. 16). Very frequently, instead of a regular germ-tube being emitted, the sporidium immediately forms a secondary sporidium (Pl. LVI. fig. 17). The primary sporidium measures 14×12 μ, and the secondary about two-thirds this.

I now proceed to describe some of the experiments I made to establish the connection between these two phases of the life-history of the parasite.

I. A. A twig was inoculated on the 7th May with sporidia of teleutospores from *Chrysopogon*, freshly collected and had lain 24 hours in water. On the 20th (13 days) small points of attack were noticed, and on one leaf three groups of spermogonia on three separate areas of invasion.

I. B. Another twig of the same branch was inoculated the same day with the sporidia of *Puccinia Caricis-filicinæ*; but this twig remained perfectly free from attack.

The whole branch began to wither on the 27th without twig I. A making any further progress, and the experiment came to an end.

II. On the 8th May some leaves were inoculated with the sporidia of *Puccinia coronata* (from *Piptatherum holciforme*, Roem. & Schult.). On the 20th (12 days) I noticed a single spermogonial patch on one leaf. But as on that date I had obtained clear proof from Experiment I. A that *Puccinia Chrysopogonis* was the related teleutospore, I attributed the single spot of attack to the accidental contamination of my inoculating material, and re-inoculated the leaves with the sporidia of *P. Chrysopogonis*, again freshly gathered and placed in water 24 hours previously. On the 30th (10 days) several distinct spots of attack were observed, and 8 leaves (other than that accidentally inoculated) presented small orange-yellow spermogonial spots, some leaves with 2 to 4 such distinct spots. On the following day (31st) I carefully counted the leaves of the twig. It had 66 leaves in all, 13 of which bore spermogonial patches; 9 of these latter bore each a single spot of attack, whilst 4 bore from 2 to 4 distinct spots each. On the 6th June I counted 20 spots of distinct attack on 15 leaves, some very large and typically brilliant in colour. On the 26th June most patches bore open ripe æcidia.

III. On the 23rd May I inoculated a twig with sporidia derived from teleutospores gathered on the 11th February and kept in my laboratory since. The spores had lain 24 hours in water, and had produced an immense number of sporidia. On the 30th (7 days) I noticed several spots of initial attack, *i. e.* characteristic points of upheaval, and one spermogonial patch. On the 1st June this twig, which bore in all 90 leaves, showed 13 leaves with spermogonial patches. On the 6th June I counted 15 spermogonial spots on 9 leaves (the other 4 had dropped). On the 19th some well-developed young æcidia were noticed, but the twig thereafter withered, and the experiment was closed on the 21st.

IV. On the same date, viz. 23rd May, another twig was inoculated with the same material, and kept under a separate shade. Four leaves were found very distinctly attacked on the 1st June (9 days); on the 6th I counted 36 spots on 17 leaves; on the 19th many leaves bore young, well-developed æcidia.

V. On the 23rd June I inoculated another twig with sporidia derived from the spores of *P. Chrysopogonis*, freshly gathered, which had lain 24 hours in water. On the 27th, when I left Simla for three days, there was no sign whatever of attack; but on my return on the 30th (7 days) I found the leaves extensively attacked in the spermogonial stage; 13 leaves were so attacked, with brilliant yellow spots, and on one leaf I counted 12 distinct foci of attack. On the 7th July I counted the leaves again carefully. One branch of the twig had 32 leaves, of which 16 were conspicuously attacked; the other branch had 38 leaves, of which 20 were attacked. Thus 36 of 70 leaves were attacked, and many in several places. Most of the leaves which escaped attack were the lower older ones.

VI. I made only one experiment in the reverse direction, namely the production of uredospore pustules with æcidiospores; but this was so successful that, taken with the evidence afforded by the preceding experiments, no others were at all necessary. I uprooted a healthy plant of *Chrysopogon* which I found, and put it into a pot in a gardener's box in my verandah. It remained there perfectly healthy for about three weeks. I then gathered some twigs of Jasmine bearing numerous ripe æcidia, and laid these over the grass. In about ten days most leaves bore the very characteristically brilliant uredospore pustules, which I have already described.

These experiments conclusively prove the genetic relationship between the æcidium and the *Puccinia.* The accidental contamination noted in Experiment II., designed to test the possible connection with *P. coronata*, is interesting in showing that even in such inoculations misleading results may easily be obtained, and that a single successful inoculation is by no means sufficient to establish relationship. Although I had no doubt that the result was due to accident, I nevertheless re-applied the sporidia of *P. coronata* (from *Piptatherum holciforme*) with great care to another twig of Jasmine, but without any result. With regard to control experiment, I may note that all nature acted as a control over my results. The season during which my positive results on Jasmine were obtained was much too dry to allow of natural attack to take place. I did not find any æcidium on Jasmine naturally until the beginning of July, and then only in the spermogonial stage, when all my experiments had been concluded. Experiment I. A and the first stage of Experiment II. may, however, be regarded as control experiments.

I propose naming this fungus *Puccinia Jasmini-Chrysopogonis.* The use of a compound specific name in the case of *heterœcious* species is, I think, so distinctly advantageous that it may be allowed to outweigh the general objection taken to such names in botanical nomenclature.

PUCCINIA JASMINI-CHRYSOPOGONIS, n. sp.; spermogoniis profunde immersis enormibus 126 μ longis 157 μ latis, paraphysibus ex ore 63 μ projectis; æcidiis immersis maculas orbiculares vel irregulariter orbiculares diametro 8 mm.–1 cm., rubro-brunneas margine flavas efformantibus; pseudoperidiis cylindraceis, brevibus, dense aggregatis, apice stellatim erumpentibus, ex cellulis hexagoniis membranis crassis globulos oleaceos rubro-aurantiacos gerentibus, circa 26×22 μ diam. compositis; æcidiosporis eximie rubro-aurantiacis ovalibus, tuberculatis, 26×20·2 μ diam., 7–8 poros gerentibus; uredosporis in soros orbiculares vel ovales congestis, rubro-aurantiacis, 33–23×26–23 μ, sparsim spinosis aliquot poros gerentibus, pedicello persistenti, paraphysibus nullis; teleutosporis in soros ovales vel late lineares fusco-brunneos congestis, ovalibus apice rotundatis ad septum constrictis, membranis crassis, levibus, 43×24 μ ad septum pedicello persistenti; sporidiis ovalibus prim. 14×12 μ, secund. aliquid minoribus.

DESCRIPTION OF PLATE LVI. FIGS. 14–23.

Fig. 14. From photograph, showing numerous æcidial patches. Natural size.

Fig. 15. Teleutospore, with lower ends of two promycelia, showing points of emergence from each cell. × 350.

Fig. 16. Upper end of promycelium, showing sterigmata, and one sporidium still adherent. Also a detached sporidium, showing spiral germ-tube. × 350.

Fig. 17. Sporidia forming secondary sporidia. × 350.

Fig. 18. Abnormal, but common form of sterile sterigmata; *a*, young, *b*, older and convoluted. × 350.

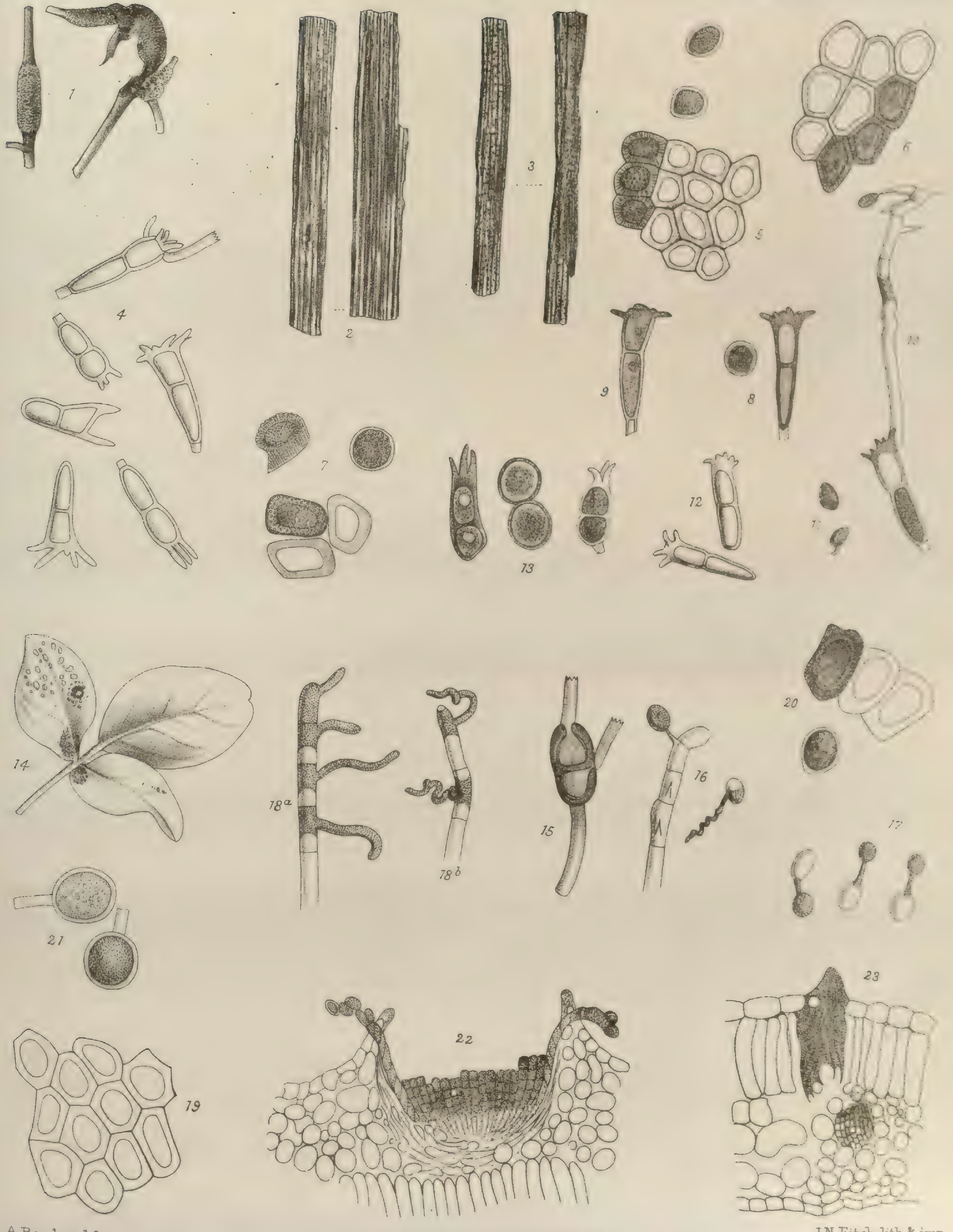
Fig. 19. Peridial cells in outline, seen flat. × 350.

Fig. 20. *a*. Æcidiospore, × 350. *b*. Detached peridial cells, × 350.

Fig. 21. Uredospores. × 350.

Fig. 22. Transverse section through æcidium. × 150.

Fig. 23. Transverse section through spermogonium. × 150.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NEW SPECIES OF PUCCINIA.

LINNEAN SOCIETY OF LONDON.

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	Part III.	1883.	0	10	0	0	7	6
	Part IV.	1883.	0	3	0	0	2	3
	Part V.	1883.	0	3	0	0	2	3
	Part VI.	1884.	0	13	6	0	10	0
	Part VII.	1884.	0	9	6	0	7	0
	Part VIII.	1884.	0	10	0	0	7	6
	Part IX.	1886.	0	7	0	0	5	0
	Part X.	1887.	0	3	4	0	2	6
	Part XI.	1886.	0	6	0	0	4	6
	Part XII.	1886.	0	8	0	0	6	0
	Part XIII.	1887.	1	7	0	1	0	0
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THE

TRANSACTIONS

OF

THE LINNEAN SOCIETY OF LONDON.

THE CAOUTCHOUC-CONTAINING CELLS

OF

EUCOMMIA ULMOIDES, OLIVER.

BY

F. ERNEST WEISS, B.Sc., F.L.S.

NATURÆ
DISCERE
MORES

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May 1892.

VIII. *The Caoutchouc-containing Cells of* Eucommia ulmoides, *Oliver.* *By* F. ERNEST WEISS, *B.Sc., F.L.S.* (*From the Botanical Laboratory, University College, London.*)

(Plates LVII. & LVIII.)

Read 21st January, 1892.

INTRODUCTION.

EUCOMMIA ULMOIDES, the "Tu chung" of the Chinese, was named and described by Professor D. Oliver in Hooker's 'Icones Plantarum'[*] from some dried material, including bark, leaves, and fruit, which had been sent to the Royal Gardens, Kew, through the instrumentality of Dr. A. Henry. Professor Oliver called attention at the time to the most singular feature about the plant—namely, the presence in its tissues of innumerable elastic threads of silvery sheen, which become apparent when the leaf, bark, or fruit is snapped across and the parts drawn asunder.

Some of the dried material was handed to me for the investigation of these threads and of the cells containing this elastic substance. But little could be made out, except that they occurred accompanying the vascular bundles of the leaf, and very abundantly in the secondary phloem and in the pericarp. I was therefore very pleased when I received from Professor Oliver a second lot of material, which had been brought to Kew through the kind offices of Dr. Henry. This material was preserved in spirit, and consisted of a large assortment of winter buds in various stages, some only just beginning to open, others provided with shoots showing distinct internodes, and with leaves about one half the size of the fully developed leaf. Many of these buds were attached to the end of the last year's branches, which were therefore entering upon their second year's growth. I have consequently been enabled to study not only the distribution and structure, but also the development of the cells containing the curious elastic threads, which are so characteristic of the tissues of *Eucommia.*

I was at first inclined to look upon these threads as of the nature of a hardened gum or resin. This, however, is not the case, as they are quite insoluble in alcohol, and both gums and resins are distinguished by their solubility in alcohol from viscin and caoutchouc.

Weinling[†] describes viscin as an intermediate substance between resin and caoutchouc, and mentions its occurrence in young parts of *Ficus elastica*, where it is later on replaced by caoutchouc. It has also been described in *Euphorbia helioscopia* by Ohlenschlaeger, who calls it a caoutchouc-like resin. But viscin differs from caoutchouc by its solubility in ether, whereas caoutchouc only swells up in that liquid.

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[*] Hooker, 'Icones Plantarum,' 3rd series, vol. xx. (1890) t. 1950.

[†] Weinling, 'Pflanzenchemie,' 1839.

The threads of *Eucommia* consist therefore of caoutchouc, for they are insoluble in alcohol, acids, and alkalis, though they become soft when treated with ammonia. They dissolve in chloroform and turpentine, and swell up in ether. When heated they melt, and they burn with the characteristic smell of burning rubber.

It is still uncertain whether the many substances described as caoutchouc or india-rubber are always the same chemical body, but that these threads consist of a substance having the usual characteristics of caoutchouc is beyond doubt.

With certain colouring reagents these threads were, curiously enough, stained in the same manner and of the same colour as the cuticle covering the epidermal cells. Thus when treated with dilute iodine they rapidly assume a dark yellow or brown colour, while the remainder of the section is only faintly stained. Similarly, methyl green acidulated with acetic acid stains both the cuticle and the caoutchouc threads intensely violet, while the rest of the section is stained light green, the xylem vessels being somewhat darker, but not of a violet colour.

From the bark the rubber can very readily be extracted. If the bark be broken in pieces and pounded in a mortar, the mass can be roughly separated into two parts—one consisting of the tangled elastic threads, with small bits of broken bark adhering to them, the other chiefly of bits of bark containing, no doubt, smaller pieces of the threads. From both parts chloroform will dissolve out caoutchouc, a larger amount naturally from the portion which consists chiefly of the threads. Thus a sample of the threads and bark weighing 443 mg. gave as much as 25 mg. of caoutchouc, while the remaining bark, weighing 607 mg., yielded only 6 mg. Taking the two quantities together, the yield of caoutchouc was 3 per cent. of the weight of the dry bark, and the same figure was arrived at independently by Professor F. W. Oliver with another sample.

The threads are clear and homogeneous, and the only impurity in the chloroform extract seems to be a little resin, which can be washed out with alcohol.

Whether the bark can be made use of commercially I must leave to those who are more experienced in technical matters, but it is interesting to note that efforts are now being made to extract gutta-percha from the bark of trees which have been drained in the ordinary way of that product. The yield in these cases was 5·3 to 5·7 per cent. of the wet bark used.*

The threads themselves *in situ* in a section, both in longitudinal and transverse aspects, are highly doubly refractive, and remain so when swelled up with ether; but they lose this optical property when dissolved in turpentine or melted into an amorphous mass.

The distribution of the caoutchouc-containing cells I had been able to determine from the dry material which I first examined, and these observations were confirmed by the examination of the material preserved in alcohol. They occur in the inner portions of the cortex, very much in the position in which the latex cells of *Euphorbia* are found, but are even more frequent in the secondary phloem, where they run between the companion cells (figs. 14 & 15), and in both cases present the appearance of very long narrow cells, attaining such a length that one only occasionally finds their ends. The sieve tubes of the secondary phloem have their sieve plates on their lateral radial, not on their transverse walls, as is the case in the primary phloem, and we find regular alternating peripheral rows of sieve tubes and companion cells, very often two of the former to one of the latter, as will be seen in fig. 14. Between the companion cells the cut ends of the caoutchouc threads will be seen.

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* Bulletin of Miscell. Information, Kew, September 1891.

In the leaf a group of caoutchouc-containing cells accompanies the ramifying fibro-vascular bundles, running just below the phloem, while in the petiole and all along the bundle of the midrib they form two groups at the side of the bundle, and do not run below it. A few cells are scattered through the parenchyma, which forms the cushion on the underside of the midrib, and a good many are found in the parenchyma of the petiole.

The pericarp of *Eucommia*, which resembles in appearance that of the Elm, is especially rich in these caoutchouc-containing cells. Below the epidermis of the pericarp we find a few layers of large chlorophyll-containing cortical cells, which become very much compressed in the dry fruit. Within these are the fibro-vascular bundles, the main trunks running longitudinally, and connected by branching and anastomosing lesser bundles. The longitudinal bundles have a strong group of caoutchouc-containing cells accompanying them on their inner side, and immediately beneath them we find a large mass of circularly running cells of the same nature, forming quite a dense coat of hyphæ-like thin-walled cells, showing their cell-walls very distinctly when the caoutchouc has been dissolved out by chloroform.

Further within we find a group of thicker-walled cells very similar to and running in the same direction as the caoutchouc-containing cells, but with curious, almost black, granules and contents. The innermost layer of the pericarp consists of sclerenchymatous cells.

The caoutchouc-containing cells reminded me in many ways of the latex cells of the Euphorbiaceæ and Apocyneæ, in spite of their remaining unbranched and containing their caoutchouc in a consolidated mass. But the main difference between these cells and the latex cells became apparent when I began to study their development, and found that they can originate anew in all the secondary growths, both in the secondary phloem and also in all new organs, whether stem or leaf; whereas all true latex cells, according to Chauveaud's latest embryonic researches *, arise from a limited number of initial cells, which can be distinguished at an early stage in the development of the embryos of Euphorbiaceæ, Urticaceæ, Apocyneæ, and Asclepiadæ.

Schmalhausen †, it is true, had previously affirmed this embryonic origin of latex cells for a large number of cases, but his observations did not include the latex cells which are found in the secondary phloem in *Ficus*, *Morus*, *Broussonetia*, *Maclura*, and *Nerium*. These, however, according to Chauveaud, are also formed from the specialized cells of the embryo mentioned above, for, as he says (p. 151) :—

"Dans les cas où la plante acquiert des formations secondaires, ces formations sont parcourues par des tubes laticifères issus des branches voisines des assises génératrices et appartenantes au système laticifère primitif. On ne constate jamais l'apparition de nouvelles initiales après les premiers stades du développement embryonnaire."

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* Chauveaud, G., in Annales des Sciences naturelles, série vii. tome xiv. (1891) pp. 1–160.

† Schmalhausen, in Mém. de l'Acad. de St. Pétersbourg, 7ᵉ série, vol. xxiv. (1877) no. 2.

In *Eucommia,* however, the caoutchouc-containing cells, whether they exist in the embryo or not, are continuously formed anew in all new secondary growths. In the very young buds and in the youngest parts of older shoots, *i. e.* therefore in all meristematic regions, no trace of these cells will be found. They first make their appearance in the cortex of a rapidly growing internode. The cortical tissue growing very rapidly here, we find a large number of transverse divisions to each initial cortical cell, the lateral walls of which have already attained some considerable thickness, and the tissue presents the appearance of a number of cells divided up by thin transverse walls (see figs. 1, 5, 8).

This appearance of young tissues is figured by Sachs in his text-book in the case of the hypocotyledonary portion of the stem of the Sunflower (fig. 56), and in fig. 94 of his Lectures for the rapid tangential growth of the cortical cells.

In the cortical cells at this stage longitudinal divisions take place in cells which are noticeable by their very granular protoplasm, which completely fills the cells, whereas the surrounding cortical cells have large vacuoles at this stage (fig. 1). The cortical cells also contain several plastids, which are absent in the cells referred to. These initial cells occur most frequently about midway between the epidermis and the fibrovascular bundles, in a region where the cortical cells are loosely packed and intercellular spaces abound, and are of considerable size; they may, however, occur only three cells beneath the epidermis, where the intercellular spaces are much smaller.

The longitudinal division of these cortical cells may take place either by radial or tangential walls. In radial longitudinal section, such as those from which figs. 1 & 4 are drawn, the two daughter cells have arisen by tangential division of the mother cell.

Fig. 6 is a drawing of a transverse section of an internode at a somewhat later stage of development, but it shows two young stages of division before any further elongation has taken place, or, at any rate, that part of the cell which has not elongated, and therefore they have the same appearance as a young stage. They are characterized by the larger diameter of the cells, by the presence of nuclei, and by the straight dividing wall. In the case in which this wall is anticlinal, I could not but compare the appearance of the daughter cells at this age with Chauveaud's figures of transverse sections of some embryos of *Euphorbia.* The figures in question are those of *Euphorbia exigua* (pl. i. fig. 2), of *Euphorbia Peplus* (pl. ii. figs. 6 & 7), and of *Broussonetia papyrifera* (pl. vii. fig. 8). In all these cases the initial cells, which develop into the latex cells, occur in groups of two, and suggest an origin (by longitudinal division of a mother cell) similar to that of the caoutchouc-containing cells of *Eucommia.*

A number of other species of *Euphorbia* (*E. falcata, E. helioscopia, E. Lathyris*) are figured by Chauveaud with a ring of latex-cell initials, and these too may have been derived in pairs from a mother cell.

The same origin of the caoutchouc-containing cells of *Eucommia* occurs in the cells of the pith (fig. 3), but takes place here in somewhat older internodes, therefore at a later period than in the cortex. The caoutchouc-containing cells in the pith are of very much rarer occurrence than the similar cells in the cortex, which fact may be connected with the splitting away of the pith cells a little later on, so that a hollow stem is formed, with septa made up of very much stretched cells of the original pith, in which septa the caoutchouc cells can be made out. But the origin of the cells is the same, and the pith at that early stage has a structure quite like that of the loosely built cortex (fig. 3).

I was also able to observe a similar origin of the caoutchouc-containing cells in the parenchymatous tissue surrounding the vascular bundle of the petiole (fig. 2). Here too they arise by a longitudinal division of a cell of this tissue, which, however, here consists of more elongate cells more closely set than those of the cortex or pith, both of which are tissues with considerable intercellular spaces.

In the secondary phloem I was not able to observe the actual origin of these cells, as the phloem cells are at their commencement more elongate than the cortical tissue, and there would be little difference between them and the caoutchouc-containing cells either in size or contents at so early a period. I cannot therefore state whether a cambium cell divides into two daughter cells, each of which grows out into a caoutchouc-containing cell, or whether these cells are each the result of differentiation of a single cambium cell. But from the young stages which I was able to observe in the secondary phloem, which contained a nucleus, and in which the caoutchouc was only in part formed, I can definitely conclude that these caoutchouc-containing cells do originate in the secondary phloem, and do not make their way there, as the latex cells of *Broussonetia* and *Ficus* for example do, according to Chauveaud.

After the longitudinal division has taken place, the cells begin to grow out, and force their ends upwards and downwards through the intercellular spaces of the tissue in which they arise. This can be seen from fig. 3 in the case of the pith, and from fig. 4 in the case of the cortex. In fig. 4 growth has as yet commenced only at one extremity, but from the later stages it will be seen that the cell grows rapidly at both ends (fig. 5). The protoplasm, being now distributed over a larger area, becomes much clearer, and at the same time a vacuole makes its appearance in the cell, and enables the protoplasm to remain applied to the increasing surface. The origin of this vacuole is seen in fig. 4, and it is also seen in the more elongate cells of fig. 5. Here, however, it is only indicated in the wider part of the cell near the nucleus, as in the outgrowing parts the superficial view is drawn in order to show the appearance of the larger granules of caoutchouc. The lighter protoplasm enables us to see more clearly the large nucleus, which remains more or less in its initial position, and indicates the original position of the cell. I have never been able to find two nuclei in any of these cells, any appearance of two being attributable to some other cell, usually the sister cell lying below the cell under observation.

To whatever length therefore these cells may grow, we must at present assume that all growth and other functions are regulated by this single nucleus. This would probably account for the fact that these caoutchouc-containing cells never branch like the latex cells of the Euphorbiaceæ, which cells Treub *, Schmidt †, Haberlandt ‡, and other observers, have shown to contain numerous nuclei. The unbranching character of the cell would not, however, preclude the existence of several nuclei, as Treub has shown that many unbranched bast-fibres have several nuclei. Though therefore a ramifying cell, such as a latex cell, requires several nuclei for its continuous growth, which seems to last during the entire life of the plant, an unbranched but very extensive cell may also have several nuclei, and it is no doubt the presence of several nuclei which has enabled the branching cell to be evolved from the non-branching one.

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* M. Treub, in Comptes rendus (1879); and in Archives Néerlandaises, t. xv. (1880) pp. 39–60.

† E. Schmidt und Fr. Schmitz, in Sitzb. d. niedrh. Ges. für Natur- und Heilkunde zu Bonn (1879). (E. Schmidt, Bot. Zeit. (1882) p. 594).

‡ G. Haberlandt, 'Function und Lage des Zellkerns,' 1886.

The caoutchouc-containing cells of *Eucommia* are therefore simpler in structure than the latex cells of the Euphorbiaceæ, and would also appear to be more primitive than the multinucleate fibres described by Treub.

The nucleus of the caoutchouc-containing cells in the early stages is elliptical or round, usually containing one large nucleolus, but in later stages it becomes spindle-shaped, and often, in fact, generally, possesses two large nucleoli. The fact that the nucleus remains in its initial position, and is of considerable size, almost touching the cell-wall on either side, is an additional support to the purely negative evidence, which has led me to the conclusion that only a single nucleus is present in these cells.

As the ends of the initial cells grow out, they make their way upwards and downwards along the path of least resistance, *i. e.* along the intercellular spaces. As these are, however, large and numerous, the course of the cells is fairly straight (fig. 8). But usually the two sister cells become separated by the obstacles they meet on their course, and even at so early a stage as that represented in fig. 6, though the caoutchouc-containing cells run in pairs, yet most sister cells are separated by considerable intervals. They can, however, usually be matched in couples. This becomes more difficult in the later stages, as is apparent from fig. 7.

The growing end of the cell is often curiously dilated into a bulbous termination, similar to those described by Schmalhausen for the ends of the latex cells in the root of *Euphorbia* embryos. But Schmalhausen speaks of a tapering end behind which the actual dilatation occurs, whereas those of the caoutchouc-containing cells of *Eucommia* terminate bluntly with the bulb. Schmalhausen's observations gave him the impression as though it were only with difficulty that the latex cell could find room, between the cells, to push in its apex, and that it endeavours by extension to fill up all possible cavities.

The dilatations I have observed in many cases, however, could have no such cause, as they were found in the middle of wide intercellular spaces (fig. 10). Immediately behind the apex, the walls, usually thin and delicate, are considerably thickened (fig. 10). In some of the bulbous terminations the contents were still of a granular nature, and had not yet coalesced into a solid mass, characteristic of their final state. In these cases the bulbous terminations contained a certain amount of substance, staining deeply with protoplasmic stains, and there is no reason to suppose that these cells were unable to continue to grow. In others, however, the contents were already fused into a solid mass of homogeneous caoutchouc, and little or no protoplasm could be observed, so that a considerable difficulty would lie in the way of our considering these as actively growing ends. I would suggest, therefore, that these dilatations, when they occur in such positions as that figured in fig. 10, indicate that the limit of growth of one of these cells has been reached, which may be due either to the nucleus having come to the end of its functional power, or, as seems more likely, to the nucleus having been cut off from communication with the growing point of the cell by a blocking up of its lumen with caoutchouc. For in many cases in which the end-bulb still contained protoplasmic substance, or at least a substance staining like protoplasm, but containing also a large amount of caoutchouc granules, the thinner portion of the cell behind the end-bulb was entirely filled with a solid mass of caoutchouc, between which and the cell-wall I could not demonstrate any protoplasm.

I searched diligently for a nucleus in these end-bulbs, which at first seemed to me likely places for additional nuclei, but could in no case discover any.

Other dilatations occur occasionally in places where growth has been hindered by some obstruction, and here, too, a thickening of the cell-wall takes place (fig. 11). It is such an irregular growth in which we get a short horizontal extension, that appears as a long cell in the transverse section (fig. 7).

The bulbous dilatations occur in the most striking manner in the teeth of the developing leaves, where they may be seen in large numbers, especially after swelling up the ordinary tissues with sulphuric acid (fig. 12). Here they are very irregular in appearance, and here they would seem to indicate that the growth of the caoutchouc-containing cells had become impeded by the slowness of the development of the leaf. Here, therefore, the cells should still be in a growing condition, and yet in many cells the contents are already clear, indicating that the caoutchouc has become set into a solid mass.

In longitudinal section (fig. 13) the bulbs will be seen arching over the end of the vessel and terminating but a few cells behind the meristematic cells of the tooth.

THE CONTENTS OF THE CELLS (fig. 9, *a*, *b*, *c*, & *d*).

During the early stages of growth of the cells above described, the protoplasm contains a number of smaller and some very much larger granules (figs. 5 and 9 *a*). These latter and some of the smaller are of the nature of caoutchouc, and can best be identified by the intense blue or violet colour which they assume with acidulated methyl green. Their solubility in chloroform is another test. These granules appear also in many of the cells of the primary phloem, in which no caoutchouc-containing cells occur (fig. 9 *d*). Nor do these phloem cells become stored with caoutchouc, but the granules seem to be re-absorbed, for in older internodes of the same shoot no such granules are seen.

In the caoutchouc-containing cells, the large granules become more numerous till the cells are densely packed with granules (fig. 9 *b*), and finally they become welded into a solid mass, which at first shows its origin from a granular matrix by numerous lines indicating splits and cracks in the contents (fig. 9 *c*). Ultimately, however, the contents become quite homogeneous, as mentioned at the commencement of this paper, and form elastic threads, which are observed on breaking asunder a bit of bark or a leaf. The contents are then drawn out of the cells and show themselves to be very elastic. If a young developing leaf be treated in this way, the contents may be pulled out before the complete fusion of the granules has taken place, and threads will be seen presenting a jagged outline owing to the granules protruding along the side of the thread. By the time the fusion has taken place it is impossible to demonstrate any protoplasmic contents to the cells, and we must assume that all further growth ceases.

CONCLUDING REMARKS.

From the foregoing description of the caoutchouc-containing-cells of *Eucommia*, it will be seen that, while reminding one in many particulars of the latex cells of the Euphorbiaceæ, yet in some very essential points they differ from them.

They agree with the latex cells in their occurrence in the inner portion of the cortex, in the secondary phloem, and to some extent in the pith. They elongate enormously, and make their way by a sliding growth into the growing regions and largely into the leaves. They contain at the commencement numerous large caoutchouc granules in their protoplasm, though these granules afterwards become welded into a homogeneous mass of caoutchouc. They differ, however, chiefly from latex cells—

(1) In remaining unbranched and containing only a single nucleus.

(2) In arising *de novo* in all secondary growths, such as the secondary phloem and in new shoots and leaves.

As far as this secondary difference is concerned they would in this agree with the latex cells of the Cannabineæ, of *Urtica*, and of *Vinca*, in which the latex cells do not arise from specialized cells of the embryo, as they do in the Euphorbieæ.

Chauveaud has, therefore, also distinguished the latter, as "tubes continus primitifs," from those of *Urtica*, which he calls "tubes continus ultérieurs." So, too, they might be called in *Eucommia*, were it not for the fact that their contents, except possibly at a very early stage, are very different indeed from what is usually termed latex. They seem to contain only the one substance, which I have taken to be caoutchouc, and never present fats, oils, or starch. I have, accordingly, preferred to call them merely what they seem to me to be, *i. e.* caoutchouc-containing cells.

Yet, morphologically, they may be equivalent to the cells usually termed latex cells, but are less specialized and less elaborate in structure than these, and I think we may therefore venture to assume that latex cells of a more organized type may have been derived from cells similar to those of *Eucommia*, and possibly our conclusions may support the views of some observers who have dealt with the relationship of the various forms of laticiferous tissues.

Pax *, in his paper on the Anatomy of the Euphorbiaceæ as affecting their classification, takes the separate closed sacs containing latex which are found in some of the Ricinocarpeæ and in the Acalypheæ as the starting-point in the evolution of the latex cells of Euphorbiaceæ. In the group of the Johannesiæ the individual cells of the articulated sacs are of different length, some of considerable length, and if, as Pax suggests, we consider the number of these cells reduced to one, and that one endowed from its first formation with a very pronounced power of elongation, we arrive at the ordinary latex cell, such as we find it in the group of the Euphorbieæ.

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* Engler's Botanische Jahrbücher (1884), pp. 384–421.

Chauveaud * inverts this order and considers the long, branching, but undivided cells of the Euphorbieæ as the most primitive form of latex tissue (" tubes continus primitifs "), just as the unicellular or non-cellular Siphoneæ represent a more primitive form than the multicellular plants. The fact, also, that the latex cells of the Euphorbieæ arise in the embryo itself seems also to strengthen Chauveaud in his conclusion, and he lays great stress on three cases in which the embryo presents the continuous latex cells, whereas in the adult plant the laticiferous system is represented by a series of closed sacs, though he has no direct observations to show that the latter have arisen by a dividing of the continuous cells of the embryo. The plants alluded to are *Aleurites triloba, Jatropha Curcas*, and *Jatropha multifida.*

My own observations on *Eucommia* tend in no way to support Chauveaud's theory of the relationship of the different forms of laticiferous tissues, but illustrate, I think, another step in the series of forms through which Pax would lead us to the highly specialized inarticulated laticiferous tubes. Pax's suggestions have been provisionally accepted by Dr. Scott †, in his valuable paper read before this Society, in which he shows how, starting from the same primitive condition of closed laticiferous sacs, we might also derive the articulated laticiferous vessels of *Manihot* and *Hevea.* The fact that these two different systems, the non-articulated cells of the Euphorbieæ proper and the articulated vessels of *Manihot* and *Hevea*, can be derived from the closed secretory sacs, such as those found in the Ricinocarpeæ, by a development towards the same end, namely, towards continuity, seems to me to be a strong claim for the correctness of Pax's suggestion; whereas, according to Chauveaud, the " tubes continus primitifs " become discontinuous by dividing into a number of separate cells, such as are found in *Cnesmone* and *Dalechampia*, only to become continuous again in the case of the articulated vessels of *Hevea* and *Manihot.*

It is not, however, my object in this paper to discuss the origin of the articulated vessels, as in *Eucommia*; my observations bear only on non-articulated cells.

I consider that we are dealing here with a primitive, though not the most primitive, form of a latex cell. The caoutchouc-containing cells of *Eucommia* are, I think, similar to the closed latex sacs described by Pax in the group of the Johannesieæ, but are somewhat more specialized, and therefore, in some respects, more like the latex cells of the Euphorbieæ proper. Their specialization shows itself in the fact that the initial cell divides into two before elongation takes place, so that we have always two daughter cells in the place of the primitive mother cell. This division of the initial cell into two reminds one, as I have stated previously, of the appearance of the initial cells figured in some of the Euphorbian embryos by Chauveaud, so that I do not regard it as improbable that this division into two may have been a step in the evolution of the non-articulated latex cells of Euphorbia.

* Annales des Sciences naturelles, Série vii. tome xiv. (1891) pp. 1–160.

† Journal of the Linnean Society, vol. xxi. (1885) pp. 566–573.

The caoutchouc-containing cells of *Eucommia* are unbranched and still contain only one nucleus, but it is easy to conceive that a division of this nucleus into several younger nuclei, a division which might become necessary by the dimensions of the cells, would enable the cell under certain conditions to branch out in other directions, as it has become normal for the latex cells of the Euphorbiaceæ.

But the faculty of branching having been acquired, and their powers of growth having been increased by their multinucleate condition, the number of these cells might very naturally become reduced. Such reductions are of frequent occurrence in the vegetable kingdom. I need only cite the reduction which takes place from multisporangiate leaves to unisporangiate forms among the Cryptogams, and the reduction of the number of archegonia which has taken place in the phylogeny of the Gymnosperms and Angiosperms.

There is also, both in the vegetable and in the animal kingdom, the well-known tendency of "anticipation," which for example, in the group of vascular Cryptogams, has caused the differentiation of sexes to be anticipated by the heterosporous forms in the sporangium, while the more primitive homosporous forms do not show that differentiation until the prothallium is developed.

This same tendency has, I think, in the evolution of the laticiferous cells, caused the embryo to produce these laticiferous cells, and their formation from cells in older tissues has become unnecessary, by reason of their excessive growth and vitality, very much as Pax suggests.

The occurrence of closed latex sacs in the adult plant in *Aleurites* and *Jatropha*, for which Chauveaud has described non-articulated latex cells in the embryo, may indicate merely the retention of the older form of laticiferous tissue by the adult plant, while the latex cells which are to supersede the closed sacs are found already starting, and at least supplying the embryo.

Whether *Eucommia* has initial cells in its embryo similar to those of Euphorbia or not we have no means at present of ascertaining, but I would like again to mention that these cells in *Euphorbia* often occur in pairs, and then present all the appearances of the initial cells in the cortex of *Eucommia*. I incline to the belief that the embryo of *Eucommia* has no such cells, first on the ground that they would be unnecessary to a plant which is so well provided with other cells in its new organs, and, secondly, because these caoutchouc-containing cells do not arise in meristematic regions, but in a secondary manner, in tissues which are far progressed towards maturity.

The function of the caoutchouc-containing cells, as far as the preceding observations go, cannot be in any way connected with the conduction of food substances; for they are closed cells filled with a solid mass of caoutchouc, which would prevent the passage of food substances as effectually as a callus plug. Their presence in large number in the leaves might suggest the idea that they conduct away substances formed in the leaf, but they terminate not so much in the assimilating layer as at the margin of the leaf, which would be much more suggestive of some sort of protection against insects or other animals, to which the caoutchouc might prove distasteful. Their occurrence, too, in the middle of the pericarpal wall in such large numbers would support this theory. If the latex cells have been derived from such cells as have been described, it would seem that their primary function was to store up the waste products, or, at all events, to secrete some substance which would render the leaves distasteful, and, therefore, more or less immune. When the laticiferous system, however, was elaborated to form a continuous system throughout the plant, whether as articulated vessels or non-articulated cells, the secondary function of food conduction may have been added to their first and primary function of protection.

How do the foregoing observations affect the systematic position of *Eucommia*? Professor Oliver, from the scanty material with which he had to deal, especially owing to the absence of flowers, did not definitely assign *Eucommia* to any natural order, but suggested that it might have affinities with the Euphorbiaceæ, and perhaps more especially with the Phyllanthoideæ. If the cells described have any morphological affinity with the latex cells of Euphorbiaceæ, they would tend to support Professor Oliver's suggestion that this plant might be associated with the Euphorbiaceæ.

The Phyllanthoideæ, however, according to Pax *, are devoid of laticiferous tissues; we should therefore have to include *Eucommia* among the Crotonoideæ, which have some laticiferous tissue, however elementary, and if we were to lay as much stress on the anatomical character of the laticiferous tissue as Pax does in his paper in Engler's 'Jahrbuch' we might place it either in a group at the side of the Johannesieæ, or between the Johannesieæ and the Hippomaneæ.

As, however, no flowers are to hand, these suggestions are merely speculative, and at present practically valueless; for, if we adopt Chauveaud's classification of the laticiferous tissues, we might associate *Eucommia*, as possessing "tubes continus ultérieurs," with either *Cannabis*, *Urtica*, or *Vinca*. The value of these anatomical characters in classification can only be secondary. Still, as they have their function as secondary characters, it may be as well to mention that in *Eucommia* we find no medullary phloem groups, and that the secondary phloem presents distinct masses, hard bast elements alternating with the soft bast.

In conclusion, I take this opportunity of thanking the Director of the Royal Gardens of Kew for putting this interesting material at my disposal, and I wish also to acknowledge the help and suggestions I received during my investigations from Professor F. W. Oliver.

---

* F. Pax in Engler's Bot. Jahrb. (1884) p. 404, and in 'Engler's Natürliche Pflanzenfamilien,' vol. iii. p. 5.

DESCRIPTION OF THE PLATES.

Plate LVII.

Fig. 1. Longitudinal section through the cortex of a young internode, showing two initial cells with dense protoplasm surrounded by the loose cortical cells. These latter possess a vacuole and plastids, which are not present in the initial cells.

Fig. 2. Two initial cells in the more closely packed cells of the petiole of a young leaf.

Fig. 3. Initial cells in the pith of *Eucommia*, showing commencement of elongation.

Fig. 4. Initial cells in the cortex beginning to elongate at one extremity, and showing the formation of the vacuole.

Fig. 5. A group of very young caoutchouc-containing cells, showing their elongation in two directions. The larger granules in these cells are grains of caoutchouc, the smaller ones protoplasmic granules. The two lower cells have been derived from one mother cell.

Fig. 6. Transverse section of a young internode. The cortical tissue has large intercellular spaces, in which the young caoutchouc-containing cells can be seen in pairs. The larger cells are those which have been cut through in the region of the nucleus.

Fig. 7. Transverse section through an older internode, in which the caoutchouc-containing cells have become more separated one from the other, and show clearer contents owing to the consolidation of the caoutchouc granules into a homogeneous mass.

Fig. 8. Longitudinal section through an older internode, showing the course of the caoutchouc cells through the very loosely packed cortex.

Plate LVIII.

Fig. 9 *a*, *b*, & *c*. Different stages in the consolidation of the caoutchouc granules. In *a* the granules are not very numerous; in *b* they almost fill the cell; and in *c* they have become fused into a single mass.

Fig. 9 *d*. Cell from the phloem of a young internode, in which large grains of caoutchouc make their appearance within the primordial utricle.

Fig. 10. Bulbous dilatation by which many of the caoutchouc cells terminate in the cortical and other tissues.

Fig. 11. Bulbous dilatation which is not terminal.

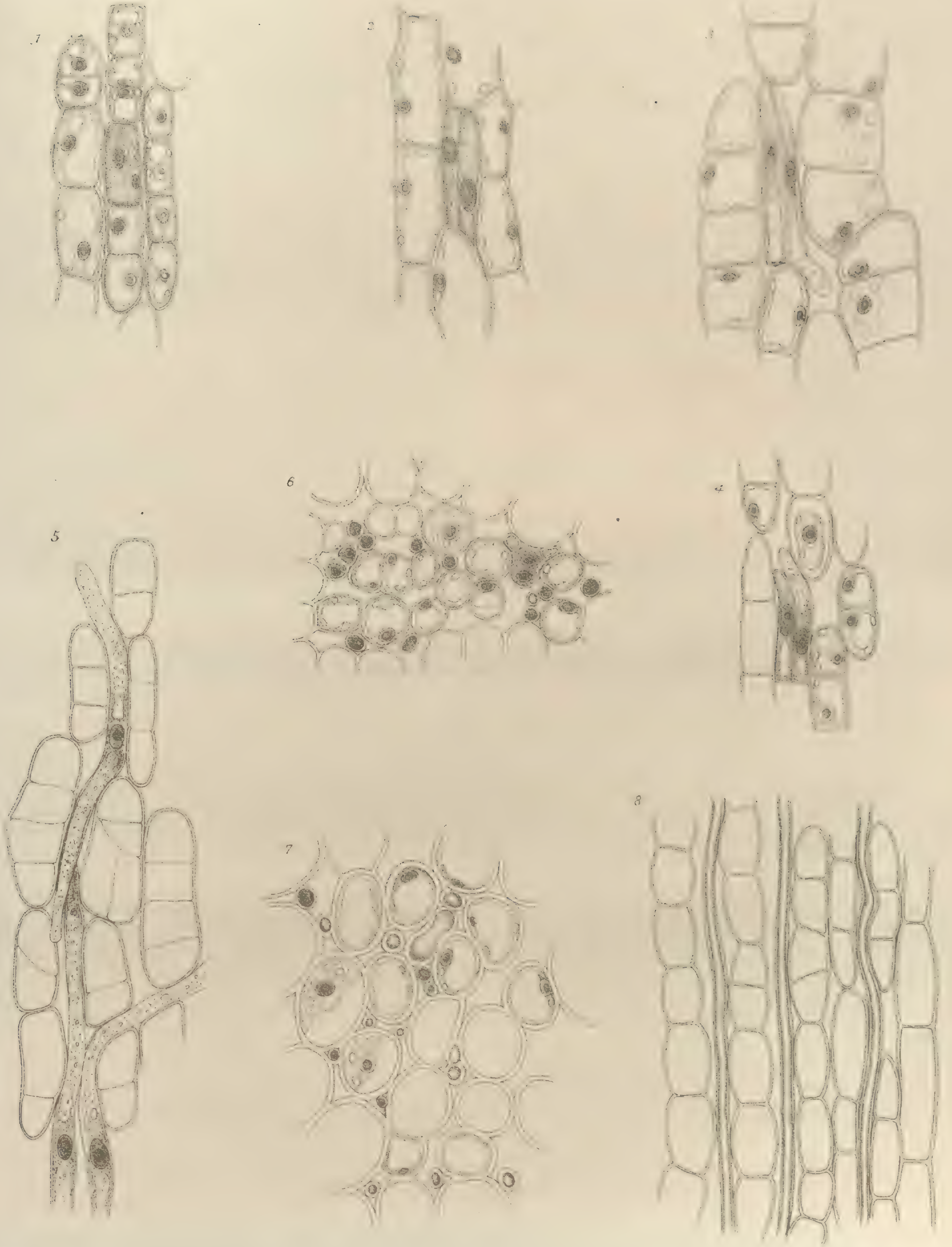
Fig. 12. Tooth of a young leaf after treatment with sulphuric acid. The leaf is rendered transparent, and shows the irregular bulbous terminations of the caoutchouc cells.

Fig. 13. Longitudinal section of tooth of young leaf, showing the termination of two caoutchouc cells.

Fig. 14. Transverse section of the secondary phloem of *Eucommia*. The caoutchouc cells are seen running between the sieve tubes and the companion cells. The sieve tubes have their sieve plates on the radial walls. *m.r.* median ray; *s.p.* sieve plate; *c.c.* caoutchouc cell.

Fig. 15. Longitudinal section of the secondary phloem, showing the course of the caoutchouc cells. Sieve plates are seen in surface over and in section.

(Figs. 14 and 15 have been drawn from preparations made from dried material.)



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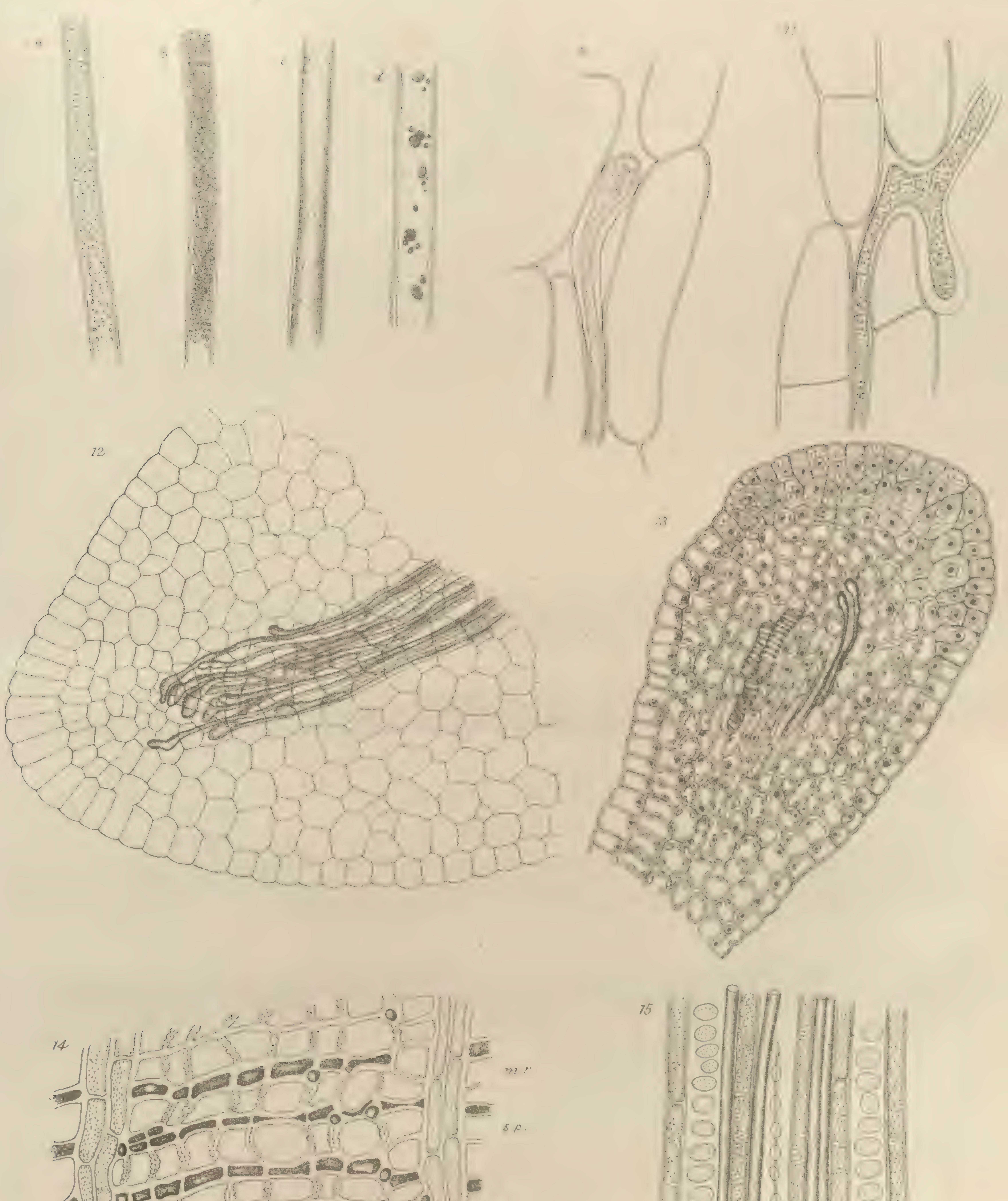
J.N. Fitch lith. et imp.

CAOUTCHOUC-CONTAINING CELLS OF EUCOMMIA.


9
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m. r.
s. p.
c. c.

F. E. Weiss del.

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CAOUTCHOUC-CONTAINING CELLS OF EUCOMMIA.

LINNEAN SOCIETY OF LONDON.

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	Part VI.	1884.	0	13	6	0	10	0
	Part VII.	1884.	0	9	6	0	7	0
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THE TRANSACTIONS OF THE LINNEAN SOCIETY OF LONDON.

ON BUD-PROTECTION IN DICOTYLEDONS.

BY

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(*Communicated by* D. H. Scott, M.A., Ph.D., F.L.S.)

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IX. *On Bud-protection in Dicotyledons.* By PERCY GROOM, *B.A., Frank Smart Student, Gonville and Caius College, Cambridge.* (*Communicated by* D. H. SCOTT, *M.A., Ph.D., F.L.S.*)

(Plates LIX. & LX.) 12

Read 18th February, 1892.

THE welfare, or even the very existence, of a plant is dependent on the preservation of the young growing parts of the shoot. Yet several circumstances conspire to render the life of the bud precarious. A growing bud is more or less exposed in position, and necessarily delicate in structure: hence it is peculiarly liable to physical injury from excess of light, extremes of temperature, and loss of indispensable water. For the same reasons buds are rendered an easier prey to hostile organisms, whilst the nutritious nature of their contents even invites attack. Not only do these young parts of a plant require protection, it is also imperative that the protective mechanism should be of such a sort as to permit of simultaneous or, at any rate, subsequent growth: hence many of the protective measures adopted by mature organs are out of the question.

The most striking illustrations of bud-protection are to be seen when the environment is peculiar. When plants are exposed alternately to a favourable and an unfavourable season, there is frequently a wide difference between the actively growing buds and the "resting buds." The latter are often covered by an envelope of scale-leaves, by persistent petioles, peculiar prophylla, modified stipules (1), &c. Goebel has described the careful manner in which the growing-point and young leaves of succulent plants are buried in the older tissue (13). These cases may be contrasted with those of plants growing under favourable conditions. Submerged plants and many plants growing in a perennially moist and warm region (5) have buds of loosely-packed leaves, so that the growing-point is all but exposed. But the means of bud-protection adopted by a plant depend as much on the character of the plant as on the environment. *Marchantia*, though growing in moist and shady places, possesses an elaborate arrangement of amphigastria curled over the growing-point and a thick coating of mucilage over the young tissue: the reason of this is that *Marchantia* is very sensitive to loss of moisture.

The need for protection on the part of the growing-point and younger leaves explains at once the fact that older leaves cover the younger leaves at the end of the shoot—in fact, that a "bud" is formed in order to permit the younger leaves developing as far as possible under the shelter of the older leaves; they are closely packed and often folded so as to take up the least room possible inside the bud (3). Frequently, too, when the outside leaves of a bud expand, the blades of the younger leaves are not immediately exposed in consequence: the latter may be covered by their own stipules (2), or they may be protected by outgrowths from the base of older leaves (e. g. *Clusia*, *Tabernæmontana*, *Fagræa*) and the outgrowths may take the definite form of stipules.

But the most critical time for the young leaves is when they are first exposed, their epidermal walls being thin and feebly cuticularized, and their chlorophyll dilute and easily decomposed. To avoid excess of light these youngest exposed leaves are frequently directed vertically. Often, too, this arrangement is associated with a diminution of the transpiring surface caused by a folding of the lamina or the close contact of two leaves. In many plants with opposite leaves, the two outermost leaves of a bud are directed vertically with their inner faces in close contact (*e. g.* many *Rubiaceæ*, *Clusia* sp., *Bucklandia populnea*, R. Br., *Veronica imperialis*). In *Durio zibethinus* the pendent arrangement of the conduplicate young leaves gives a characteristic appearance to the tree. In some plants with stalked leaves the change of direction of the lamina leads to the older leaves at the end of a shoot forming an umbrella-like screen over the youngest exposed leaves (e. g. *Gossypium*, *Dombeya Mastersii*, species of *Abutilon*, *Hura crepitans*, *Begonia* sp.). Frequently the young leaves are coated with glistening hairs. That these hairs perform their functions whilst the leaves are young, is proved by the fact that the older leaves may be apparently quite glabrous. One of the functions of these hairs is to protect the young leaves, for they diminish transpiration and radiation and reflect light. The young leaves of many plants are rendered conspicuous by their colour, being generally red, reddish brown, or brown. These colorations are especially common in plants exposed to strong sunlight, *i. e.* alpine plants and tropical plants (e. g. sp. of *Ixora*, *Calophyllum*, *Treculia africana*, Decne., *Garcinia Cambogia* var. *papilla*, *Nephelium Litchi*, *Clusia* sp., *Wormia Burbidgei*). Various experiments make it probable that these colouring-matters protect the young leaves from excess of light (16). At the same time they may be merely the unavoidable results of metabolism, or have some other significance; for we find that the colour is often due to the presence of tannin or tannin-like bodies. Also similar red colouring-matters are found on parts not exposed to light, *e. g.* in villous colleters, &c. (*Cosmibuena*, *Hoffmannia*). These villi are not manufacturing the colouring-matters for the use of the young leaves; for, as far as I could see, the colouring-matters were never transported from the colleters: in addition the leaves of *Cosmibuena* are green when they emerge.

Many buds have a great protective auxiliary in the secretion which covers and fills them. This secretion consists of gummy mucilage or resin, or both together (7 & 17); it is secreted by the general epidermis, by colleters, or by "leaf-teeth." These "blastocolla"-secreting glands are characterized by their early development and their short-lived activity. The colleters, further, occur only on that essentially protective organ, the leaf-base, or on its outgrowths (stipules). After functioning for a short time the colleters, and often the stipules which bear them, dry up or drop off. These facts sufficiently indicate that these external secretory organs are definitely formed for the sake of the bud. It is, unfortunately, impossible to excise these structures early, and thus give confirmatory evidence of their importance to the bud; I did, however, remove the secretory hairs of the youngest exposed leaves of a species of *Ochna*. The hairs occur at the margin of the leaf and only secrete in the bud, and not later in life.

The result of the excision was *nil*. The experiment merely showed that the hairs are not essential to the older leaves. The following points are worthy of note with reference to the secretion :—(i.) the secretion, being adhesive, glues all the young parts together; (ii.) forming a thin coat over the young exposed leaves it diminishes transpiration by reflecting some of the sun's rays; (iii.) mucilage, being hygroscopic, diminishes the loss of water due to transpiration. In addition it might be suggested that mucilage prevents the bud being drained of moisture by excessive transpiration of the older leaves. Wiesner states that in the well-known sympodial shoots of dicotyledonous trees the death of the growing-points is occasioned by the older leaves draining the apex (14). Pfeffer's measurements of the osmotic power of gum arabic give an idea of the energy with which the secretion sucks in water. Attention does not appear to have been called to the fact that the employment of a hygroscopic substance like mucilage (and tannin) is an admirable means of controlling the water-supply of an organ for two reasons: first, the osmotic power of a solution increases with a rise of temperature; secondly, the osmotic power increases with the concentration of the solution. The result is that when a bud is in greatest danger of losing all its water—*i. e.* when the temperature is high and a considerable amount of water has been evaporated from the mucilage—the remaining water is held most firmly or a first supply of water is absorbed most fiercely.

It is probable that this external secretory apparatus is also of use in removing excreta from the young cells. The following reasons may be given in support of this view:—(i.) the precocious development of internal excretory organs suggests the importance of a speedy removal of products which would retard the activity of the young cells; (ii.) many plants which possess colleters &c. also have internal structures which manufacture or store up the same substances, resin and mucilage, e. g. *Rubiaceæ, Apocynaceæ, Asclepiadeæ, Gutiferæ, Dilleniaceæ*; (iii.) we are unable to attach any significance to the secretion of mucilage by the leaf-tips of certain submerged water-plants, e. g. *Myriophyllum, Ceratophyllum* (8); (iv.) it is suggestive, too, that laticiferous tubes should penetrate the colleters, as I have shown to be the case in the *Apocynaceæ*. This view of the double nature of the service performed by colleters affords a means of conceiving of their primary mode of origin in several distinct unconnected families. Originally, then, the young epidermis of the plants became the recipient of excreta. The plant soon found the advantage of completely ejecting the excreta, so that deeper tissues need not share in their storage or removal: so the excretion oozed through the epidermal walls first over the whole surface of the leaf, and subsequently in localized places. The plant discovered the benefit of the secretion as a protective agent, and thence the external secretory apparatus was elaborated till it reached its present state of perfection. The various stages above mentioned actually occur in different plants. The whole process may be compared to that by which substances which were originally coloured katabolites (tannin, &c.) subsequently became also protective in function.

Many plants possess other glands which may be protective in function—water-stomata. Gardiner (12) and Moll regard these as species of safety-valves to permit the escape of excess of water, and thus prevent rupture of the delicate tissue of the young leaves.

Special Work *.

The following observations refer chiefly to colleters. It may therefore be briefly stated that it is to Hanstein alone that we are indebted for our knowledge of colleters of Dicotyledons. He considers that colleters were always trichomes, whilst he supposed that the mucilage part of their secretion first appeared as a colligenous layer in the cell-wall.

My own observations refer to plants belonging to *Rubiaceæ*, *Apocynaceæ*, *Asclepiadeæ*, *Guttiferæ*, *Dilleniaceæ*.

RUBIACEÆ.

Cosmibuena obtusifolia is a native of tropical S. America. The opposite stalked leaves have between them two large leaf-like stipules which possess no midrib. On closer examination it is seen that the bases of the stipules are continuous with a short outgrowth from the inner face of the leaf-base. So the stipules may be described as sheathing, but the axillary portions of the stipules are very small. This sheath bears a number of villi, which thus form a complete zone round the stem.

The Bud.—The apex of the shoot may be seen to be surmounted by two (rarely three) stipules glued tightly together by the "blastocolla." On separating these two stipules the next two leaves are seen directed vertically upwards, just within, with their inner faces closely adhering (Pl. LIX. fig. 1); these leaves by their growth force the apices of the stipules apart and so emerge. Thus the stipules do not protect the leaves to which they belong; they protect the younger leaves. The stipules subsequently drop off, and the scars are covered with cork. The actual growing-point is at the base of a relatively deep pit, the wall of which is formed by the concentric sheaths belonging to several successive pairs of leaves and stipules. The growing-point is of course covered with secretion.

Development of the Stipules.—In the earliest stage I succeeded in observing that there was an annular outgrowth of tissue common to leaf and stipule: this was thicker where the young leaves had already made themselves visible. The stipule was merely represented by a tiny triangular protuberance.

Structure and Development of the Villi.—Each villus is, roughly, pear-shaped, and consists of a single layer of palisade-like secreting-cells, which cover a mass of thin-walled "conducting parenchyma" cells. Each villus arises as an elevation of a few cells. The young epidermal cells at this spot are, in general, more elongated at right angles to the surface, and possess larger and more deeply-staining nuclei than the adjoining cells (fig. 2). The cells below them are smaller and stain more deeply than the rest of the parenchyma. The epidermis of this slight protuberance divides radially only: these divisions and those of the subjacent cells lead to the formation of a considerable outgrowth. At this stage the young external secreting-cells possess large nuclei and a deeply-staining granular protoplasm. The size of the nuclei and the depth of staining of the protoplasm decrease as the cells approach the non-secretory epidermal cells. The subsequent changes consist in the radial division and elongation of the external (epidermal) cells to form a secretory layer, and the division and elongation of the internal cells to form the conducting parenchyma (fig. 4). As the secretory cells grow older their staining qualities diminish, and the nucleus finally becomes a feebly-staining bubble-like body. Thus it is seen that the villus is an emergence. The villi are red in colour and secrete mucilage and resin.

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* Unfortunately, owing to my leaving England, I was unable to complete the work as I should have wished. It was not till too late that I found how easy it was to be deceived by the use of Hanstein's reagent in testing for resin; so that I cannot positively state that resin is present in all the secretions, though gummy mucilage is.

Coprosma Baueriana (and *C. Baueriana* var. *variegata*) is a native of New Zealand. Its leaves are opposite, stalked; their bases are continuous with small triangular interpetiolar stipules. But the stipules are really sheathing in that they are continued as a small cushion on the inner face of the leaf-base. The villi form a complete zone round the stem, being perched on the top of these peculiar sheathing-stipules. Each triangular stipule possesses about five villi, the median one of which is the largest and is situated at the apex of the triangle (fig. 6).

The growing-point is at the bottom of a small pit formed just as in *Cosmibuena.*

Development of the Stipules.—The development of the leaves and their stipules is so nearly simultaneous that I only succeeded in discovering leaves without well-defined stipules in a few lateral buds. The young lateral bud is flattened in contour; the first leaves arise as distinct swellings in the transverse plane of the bud. Very shortly after the tissue between these two leaves grows up, so that at this stage there is an annular outgrowth with two considerable prominences, which are the two leaves. But the interpetiolar part soon grows more vigorously at its median point, so as to form the large median terminal villus (fig. 6). The other villi arise successively lower down, those lying in an axillary position forming later.

Structure and Development of the Villi.—Each villus is a pear-shaped, shortly-stalked body, possessing the typical palisade-like secreting layer and a central mass of conducting parenchyma-cells. Amongst the latter are many large cells containing raphides. The villus develops like that of *Cosmibuena* (figs. 7 and 8). The modified nuclei of the old cells are especially noticeable.

Hoffmannia macrophylla (syn. *Higginsia macrophylla*) is a native of Guatemala. Between each pair of large opposite leaves lie two small triangular hairy stipules. The whole of the upper (inner) face of each stipule is raised into irregular glandular ridges and lobes. Each glandular elevation consists of a superficial layer of palisade-like secretory cells covering a tissue of somewhat elongated parenchyma-cells (figs. 9 and 10). Many of these parenchyma-cells are enlarged and contain raphides. As in all *Rubiaceæ*, the stipules and young parts generally are rich in tannin, which is especially collected in the epidermis hairs and subepidermis of the stipule. Resin and gummy mucilage form the secretion. The glandular outgrowths and some (all?) of the stipular hairs secrete. In the latter one easily sees pits in the transverse walls of the cells (fig. 11) and protoplasmic intercommunication. The cuticle of these hairs is raised, but outside the unbroken cuticle of many of the hairs one sees the small masses of the secretion, which, however, may possibly have been secreted by other cells.

The growing-point of the stem is surrounded by several concentric sheaths belonging to two or three pairs of leaves and their stipules. The leaves and stipules arise (almost) at the same time, so that I failed to find leaves without stipules. At first there is only a very insignificant sheath common to stipule and leaf, later it increases in size; but when the leaves are mature, one only sees slight indications of the fact that leaves and stipules originally formed a shallow sheath round the stem.

The first trace of the glandular surface of the stipule is a tongue-like emergence which hangs down from the apex of the stipule on its inner side; this gland, in fact, looks just like the incurved apex of the stipule (Pl. LX. figs. 12 and 13). Gradually the epidermis of the inner face of the stipule assumes the form of a secreting epithelium, the change travelling in a basipetal direction. The modifying epidermis is raised up here and there into lobes and ridges, which at first hang down over the growing-point and younger leaves.

Gardenia florida, Linn., has its leaves in opposite pairs, or, more rarely, in whorls of three. The stipule forms a continuous sheath surrounding the stem, and in the young bud it completely invests the younger leaves till forced open by their growth (Pl. LIX. fig. 14). Numerous villous colleters line the inner face of the leaf- and stipule-base. These colleters secrete the well-known *Gardenia*-resin, which is really a mixture of gummy mucilage and resin: this secretion has a disagreeable odour, and is used in India to protect objects from insects. These colleters also occur on the side of the calyx-base.

Mode of Secretion.—Both the mucilage and the resin arise in the protoplasm of the secreting-cells. Very young secreting-cells are square in outline; they possess a granular protoplasm and a good-sized nucleus. They soon elongate in a direction at right angles to the surface of the colleter. At this stage, sections cut in two per cent. solution of potassic nitrate showed the protoplasm slightly withdrawn from the walls of these cells. Adding iodine solution or potassic bichromate, small bubbles of mucilage (or mucigen) could be seen protruding from the surface of the protoplasm beneath the external and lateral cell-walls (Pl. LX. figs. 16, 17, 18). In the more central parts of the cytoplasm granules or globules of smaller size could be seen. Owing to the small size of the latter, I am unable to state whether they are proteid or mucilaginous in nature; but the appearances naturally suggest that they change into the mucilage drops found towards the outside of the protoplasm. Thus the mucilage arises in the form of droplets in the cytoplasm; the droplets are expelled through the lateral and external cellulose walls, where they fuse to form rod-like or plate-like masses, which in turn unite to form a subcuticular mass. The secretion ultimately invests the cells on all sides, except the inner side, and raises the cuticle to a considerable height (fig. 18). The protruding drops of mucilage within the cell, and the smaller central granules or globules, stain slightly differently from the mucilage which lies under the cuticle, even after the removal of the resin. This suggests that some change ensues as the drops pass through the cellulose wall or after their expulsion from the cell. Thus the mode of origin of the mucilage appears to resemble that described by Gardiner and Ito (15), as occurring in the hairs of the paleæ of *Blechnum* and *Osmunda*. Concerning the origin of the resin, I can only give the bare fact, as Hanstein originally gave it in other types, that resin occurs inside the secretory cells.

Food is conducted to the secretory cells partially in the form of carbohydrates, for transitory starch occurs in the conducting parenchyma of the colleter.

Gardenia laurifolia (?) resembles the preceding, except that the leaves are in whorls of threes, and when young are densely coated with hairs (fig. 14).

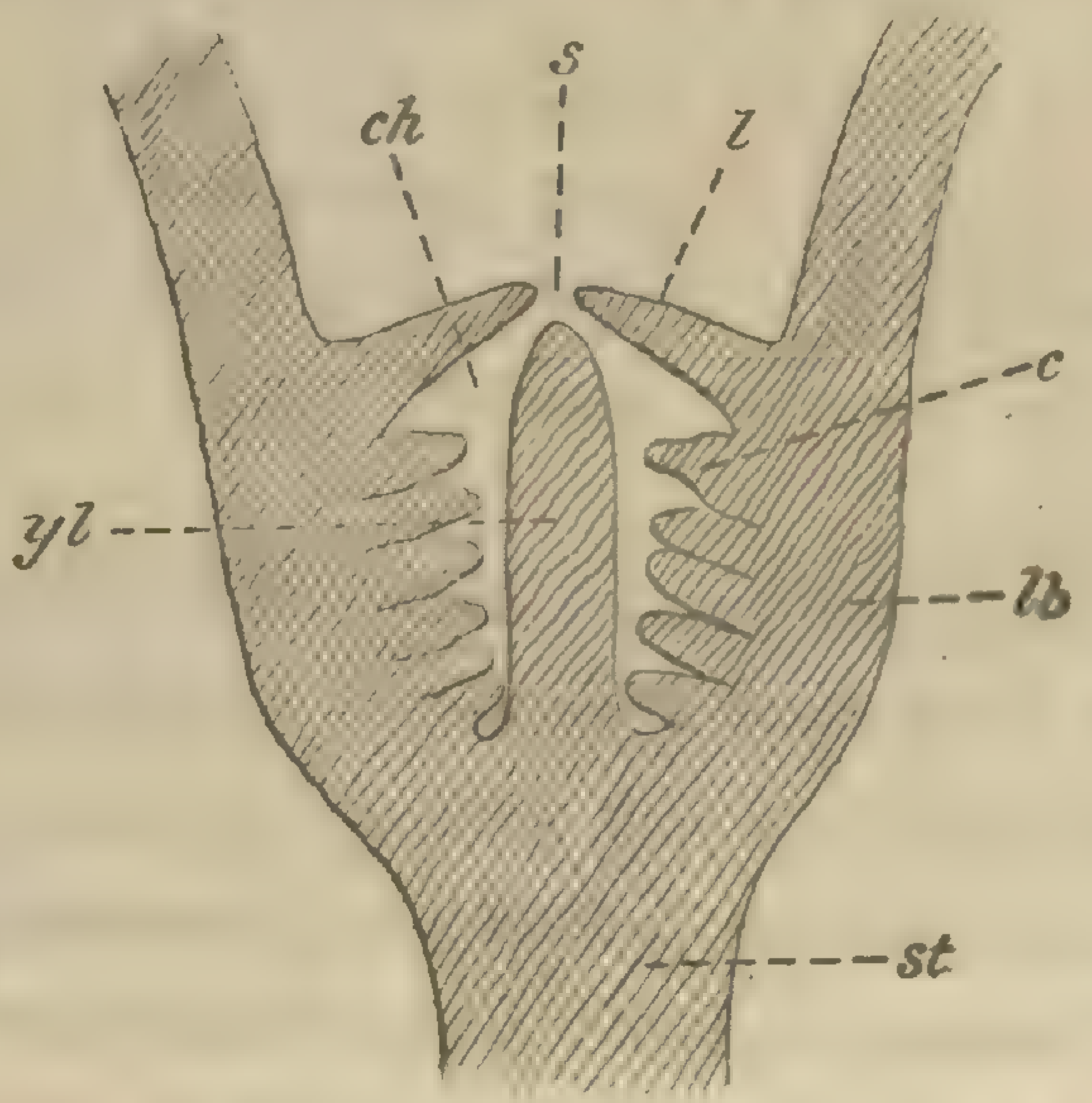
In *Pavetta indica* the long strap-like colleters and the exceedingly elongated, often spirally thickened, woolly hairs form the basis of a complete and striking protective mechanism.

In the evil-smelling *Pæderia fœtida* the colleters are unusually large, and their relatively late development suggests a more lasting function than is usual to colleters.

In *Sarcocephalus* sp. the villi are numerous; the simple hairs are represented by a papillose epidermis on the outer (lower) faces of the young leaves.

APOCYNACEÆ.

Tabernæmontana dichotoma.—Treub describes the bud as protected by a coating of a wax-like substance secreted by colleters; but it merits a more close examination. The leaves are decussate, stalked, but connate. Many growing buds present the following appearance:—The shoot ends in two leaves, the fused "bases" of which cover the younger leaves and apex, and only leave a narrow slit between them. This terminal slit (fig. 19) and the parts adjoining are covered by secretion. Forcing these two terminal leaves apart, one sees that not only are the "bases" of the leaves fused, but that there are minute ledge-like outgrowths growing out from the inner faces of the two leaf-"bases." These ledge-like outgrowths, together with the fused leaf-bases, enclose a bell-shaped cavity, in which lie the younger leaves (fig. 22). The only opening to this cavity is the above-mentioned slit which runs in a plane at right angles to the two leaves in question. The walls of the cavity, or chamber, are lined by villous colleters which secrete copiously. From the floor of the chamber rise two more leaves arranged in a plane at right angles to the preceding; they are merely a repetition in miniature of the older pair, except that their interbasal chamber encloses the growing point and tiny leaf-rudiments. When growth takes place the largest enclosed leaves push through the slit, which, it will be noticed, has its plane coinciding with that of the emerging leaves (figs. 20 & 21). The lips of the slit are thus forced asunder, or naturally gape asunder by their own growth, and the young leaves emerge, doubtless, coated with the secretion. Lower down the stem the fused "bases" &c. of the mature leaves form a tight-fitting collar round the stem, and serve to protect the axillary buds.



Diagrammatic longitudinal section through bud of *Tabernæmontana.*—*ch*, chamber; *s*, slit; *l*, ledge (stipule); *c*, colleters; *lb*, base of leaf; *st*, stem; *yl*, younger leaf enclosed in chamber.

Structure of the Villi.—The villi call for no special description; they are perfectly normal in structure, but spherocrystals occur in place of raphides. Delicate vascular bundles run close up to the villi, so that the "nerve-parenchyma" and conducting parenchyma of the colleters are directly continuous. Many laticiferous tubes traverse the leaf-parenchyma and send branches into the colleters (fig. 23).

Judging from the alcohol material at my disposal, the secretion seems to be of a resin-mucilage nature rather than a "wax-like substance." The papillose epidermis on the upper face of the "ledges" aids in the process of secretion.

Alstonia scholarius, R. Br., in its mode of bud-protection reminds one of *Tabernæmontana.* Examining with the naked eye, a circlet of leaves is seen at the apex of the stem. From the base of each leaf a small tooth-like axillary process projects and lies above the younger leaves; this tooth-like process is obviously homologous with the ledge-like process of *Tabernæmontana*, and both may be described as axillary stipules.

Allamanda sp.—The leaves are stalked and exstipulate, and according to the species are arranged in whorls of two, three, or four leaves. On the inner face of the "base" of each leaf of the calyx-lobes is a row of about five villi: these villi cover the bud with a gummy mucilage and resin secretion.

Structure of the Villi.—The villi are normal in structure, but it may be mentioned that laticiferous tubes penetrate them and frequently ascend to the secreting cells even (fig. 24). The secreting-cells resemble some described by Hanstein, so they may be described more in detail. In a mature secreting-cell the general protoplasm is very granular and the nucleus lies in the middle of the cell. Typically a large tannin-globule rests in the inner (basal) part of the cell, or sometimes there are several similar globules. On removing the tannin it is seen that it merely soaked a viscous substance: the latter stains pink with Hanstein's reagent, and is what Hanstein called "amyloid substance" (probably a mucilaginous substance). Outside the cells the secretion first appears in the intercellular spaces between the upper ends of the secreting-cells, rather than outside their outer walls. As the secretion increases in quantity it penetrates deeper between the cells and forms a sort of honeycomb structure. Some of the secretion is visible outside the cuticle before the rupture of the latter; so some of the secretion must pass through the cuticle. It was this sort of appearance which led Hanstein to suppose that two cuticles might be formed. Often in older stages it is visible, so one cannot resist the conclusion that the secretion may dissolve the cuticle.

Landolphia sp.—We might anticipate that the long "feelers" of this climbing plant, with their tiny leaves and elongated internodes, would display a complete arrangement for protecting the young leaves; and the colleters do appear to secrete for a longer period than on plants not possessing those long sunlight-bathed "feelers."

Nerium oleander has colleters and woolly hairs.

ASCLEPIADEÆ.

Asclepias curassavica.—Hanstein figured and described the colleters which occur on the leaf-base. It may be added that villi also occur on the inner face of the calyx-base.

Ceropegia stapeliæformis.—At the base of each small, triangular, succulent leaf is a row of five or six conspicuous yellow colleters (fig. 25). The colleters are more or less pear-shaped; or they may be lobed, as if two colleters were fused. In structure the colleter is a typical villus, but a vascular bundle runs for some distance in the axis of the colleter. Raphides do not occur in the villus. Villi are also present on the calyx.

GUTTIFERÆ.

Clusia rosea has opposite stalked leaves. On the dorsal (upper) face of the leaf-stalk base is a peculiar whitish "cushion" of tissue, which is hollowed out somewhat in the form of a boat. In addition there is a transverse row of colleters situated nearer the point of attachment of the leaf.

Bud.—Many shoots terminate in two leaves, the cushions of which are closely applied so as to completely enclose the youngest leaves and growing-point (*cp.* figs. 26 & 28). As growth continues the "cushions" gradually separate, and the next pair of leaves emerges through the gaping slit thus formed (fig. 27). The lateral buds are in addition protected by a peculiar "prophylla" (*i. e.* first leaves of the branch), which are small and sessile (fig. 29).

Structure of Colleters.—The colleters are abnormal in structure. The typical palisade-layer of secreting-cells has become split into several layers of cells arranged at right angles to the surface. The conducting parenchyma is present as usual (figs. 30 & 31). In the other colleters the secretion may be seen arising in a lysigenous manner in the secreting layers, and forming irregular star-like masses.

Structure of the Cushion.—The epidermis of the "cushion" is composed of narrow cells with their long axes directed at right angles to the surface. There is a thick cuticle. Between this layer and the ordinary parenchyma of the leaf-stalk lie several layers of elongated, thick-walled, parenchyma-cells. The walls of these cells contain a considerable amount of water and are copiously pitted. Protoplasmic strands pass into the pits and to (through?) the membranes. The cells contain resin, tannin, sphero-crystals, and gummy mucilage. The internal secretory passages pass right in amongst these cells, as if to conduct their products thither.

Loganiaceæ.—I noticed two *Fagræas* in the houses at Kew in which the bud-protection is precisely similar to that in *Clusia* as far as external features go. The young buds, too, seemed to be coated with secretion, so probably colleters are present. Unfortunately I was unable to obtain a bud for examination. (I have in Hong Kong observed colleters in some other *Loganiaceæ.*)

DILLENIACEÆ.

Wormia Burbidgei is a native of Borneo, with alternate leaves. Examining the ends of the shoots at first no buds are visible; but a glance at the youngest leaf visible reveals the fact that the youngest leaves are stowed away in it. What look like the right and left halves of the basal part of the lamina are folded over towards the dorsal (upper) face of the leaf, and are fused to form a cylindrical chamber (fig. 32), which has a narrow slit-like aperture at its top. The chamber is found to contain a younger leaf, whilst the unoccupied space is filled with secretion. This enclosed leaf contains in its sheathing base younger leaves, and finally the growing-point. The young leaf arises in the form of an annular outgrowth surrounding the growing-point. This ring is more developed on the side which produces the lamina. The ring expands later into the "sheath." The oldest enclosed leaf pushes through the slit at the top of the sheath surrounding it, and by its growth ruptures the latter down to its very base. The emerging leaf is coated with secretion and is brown in tint; the brown tint is due largely (solely ?) to the presence of tannin.

The secretion is poured out by the epidermis of the young leaf and by a few capitate hairs. It is worthy of note that there is an internal secretory apparatus producing resin and mucilage. The internal secreting-cells arise very early and are seen in very young leaves and high up the growing-point.

Conclusions concerning Colleters.

1. Villous colleters are frequently emergences; they are emergences in their mode of origin. Frequently, too, their emergence nature is made clear by reason of the fact that laticiferous tubes or vascular bundles penetrate them.
2. They are formed for the sake of the bud, being protective, also probably excretory, in function.
3. *Mode of secretion* in *Gardenia florida.*
    (i.) Secretion commences very early indeed in each cell.
    (ii.) The mucilage (mucigen ?) arises in the form of droplets in the cell-protoplasm.
    (iii.) There are traces of a difference between the secretion inside the cell and that outside the cellulose wall.
    (iv.) Resin occurs inside the secreting-cells.
4. The secretion in part passes through the cuticle in some plants at any rate (*Allamanda*).
5. There never was a trace of the formation of two cuticles in the plants observed.
6. *Contents of the Villi.*—Food is conveyed to the secretory cells in a carbohydrate form, for transitory starch occurs in the conducting parenchyma of the colleter. In addition raphides or sphero-crystals, colouring-matters, and tannin are found in villi.
7. It is significant that laticiferous tubes, containing substances identical with those normally found and even secreted by the villi, pass into the colleters.

I take the opportunity of thanking Mr. Walter Gardiner, F.R.S., for his constant help throughout the progress of the work. Indeed, were it not that he would be rendered responsible for all the statements and views expressed in this paper, his name would be fitly on the titlepage. I desire also to express my thanks to Mr. M. C. Potter for material of *Gardenia laurifolia* and *Tabernæmontana dichotoma,* and for a figure of the former.

Literature on Bud-protection.

1. Feist.—"Ueber die Schutzeinrichtungen der Laubknospen dicotyler Laubbäume." Nova Acta Acad. Cæs. Leop.-Car. Bd. li. p. 303 (1887). This paper gives the previous literature.
2. Hilburg.—F. Hildebrand, 'C. Hilburg's Dissertation über den Bau und die Funktion der Nebenblättern.' (Abstract in 'Flora,' 1878, p. 161.)
3. Grew.—'Anatomy of Plants.' Folio, London, 1682.
4. Kerner von Marilaun.—'Pflanzenleben.' Bd. i. (1888.)
5. Treub.—"Iets over knopbedekkung in de Tropen." Handelingen van het eerste Nederl. Natuur- en Genees-kundig Congres, gehouden te Amsterdam, 1887. (Abstract in 'Botanisches Centralblatt,' 1888, Bd. xxxv. p. 328.)
6. Reinke.—"Beiträge zur Anatomie der an den Laubblättern, besonders an den Zähnen derselben, vorkommenden Secretionsorgane." Pringsheim's Jahrbuch, Bd. x. pp. 117–178 (1876).
7. Hanstein.—"Ueber die Organe der Harz- und Schleim-Absonderung in den Laubknospen." Bot. Zeit. 1868, pp. 697, 721, 745, 769.
8. Borodin & Vochting.—Quoted in Reinke's paper (l. c.).
9. Mikosch.—"Beiträge zur Anatomie und Morphologie der Knospendecken dicotyler Holzgewächse." Sitzungsber. der kais. Akad. der Wiss. zu Wien, Bd. lxxiv. Abth. 1, Nov. Heft (1877).
10. Cadura.—'Physiologische Anat. der Knospendecken dicot. Laubbäume.' (Breslau, 1886.)
11. Sorauer.—'Pflanzenkrankheiten.' Bd. i. pp. 357–362 (1886).
12. Gardiner.—"On the Physiological Significance of Water-glands and Nectaries." Proceed. Camb. Philos. Soc. vol. v. pp. 35–50 (1883).
13. Goebel.—'Pflanzenbiologische Schilderungen.' Bd. i. Marburg, 1889.
14. Wiesner.—'Biologie der Pflanzen.' Bd. iii. Wien, 1889.
15. Gardiner & Ito.—"On the Structure of the Mucilage-secreting Cells of *Blechnum occidentale* (L.) and *Osmunda regalis* (L.)." Annals of Botany, 1887.
16. Haberlandt.—'Physiol. Pflanzen Anatomie,' pp. 75 & 76. (1884.)
17. Goebeler.—"Die Schutzvorrichtungen am Stammscheitel der Farne." 'Flora,' 1886.

DESCRIPTION OF THE PLATES.

Plate LIX.

l, *l'*=leaf; *s*, *s'*, *s''*=stipules; *v*=villus; *se*=secretion; *c*=cuticle.

Fig. 1. View of the bud of *Cosmibuena obtusifolia*, with one stipule removed, to show the enclosed pair of leaves and the secretion rendered opaque by alcohol. *g*=colleters.

Figs. 2, 4. Development of villus of ditto. (Instead of fig. 3, which was lost in transmission, see youngest colleter in fig. 7.)

Fig. 5. Bud of *Coprosma Baueriana.*

Fig. 6. Longitudinal section of bud of ditto, taken on one side of the growing-point. Shows especially the terminal villus of *s* and *s'*, *s''* developed earlier than the lateral villi. *y.v.*=young villi.

Fig. 7. Longitudinal section of young villi and growing-point of a lateral bud of ditto. *a*=apex of shoot.

Fig. 8. Old secretory cells of villus of *Coprosma Baueriana*, var. *variegata*, showing the modified nuclei.

Fig. 9. Transverse section of a stipule of *Hoffmannia macrophylla*.

Fig. 10. Surface section of ditto.

Fig. 11. Two terminal cells of a hair of stipule of ditto.

Fig. 14. Bud of *Gardenia laurifolia* (?).

PLATE LX.

Fig. 12. Longitudinal section of a young stipule of *Hoffmannia macrophylla*.

Fig. 13. Longitudinal section of a bud with older stipules of ditto.

Fig. 15. Mature colleter of *Gardenia florida*.

Fig. 16. Young secreting-cell of colleter of ditto. *a* is focussed to show the minute protuberances of mucilage studding the surface of the protoplasm ; *b* is focussed into the centre of the cell.

Figs. 17 & 18. Slightly older secreting-cells of ditto.

Fig. 19. Terminal bud of *Tabernæmontana dichotoma*.

Fig. 20. Ditto, but showing young leaves emerging.

Fig. 21. The same bud as preceding, but rotated through an angle of 90°, and with one of the covering leaves removed.

Fig. 22. Longitudinal section through apex of ditto. *le*=" ledge" ; *g.p.*=growing-point.

Fig. 23. Longitudinal section through the base of a colleter of ditto, showing a laticiferous tube (*l.t.*).

Fig. 24. Longitudinal section through a portion of a colleter of *Allamanda* sp., showing a laticiferous tube ascending to the secreting-cells.

Fig. 25 *a*. Leaf of *Ceropegia stapeliæformis*.

Fig. 25 *b*. Section of colleter of ditto.

Fig. 26. Bud of *Clusia grandiflora* (?).

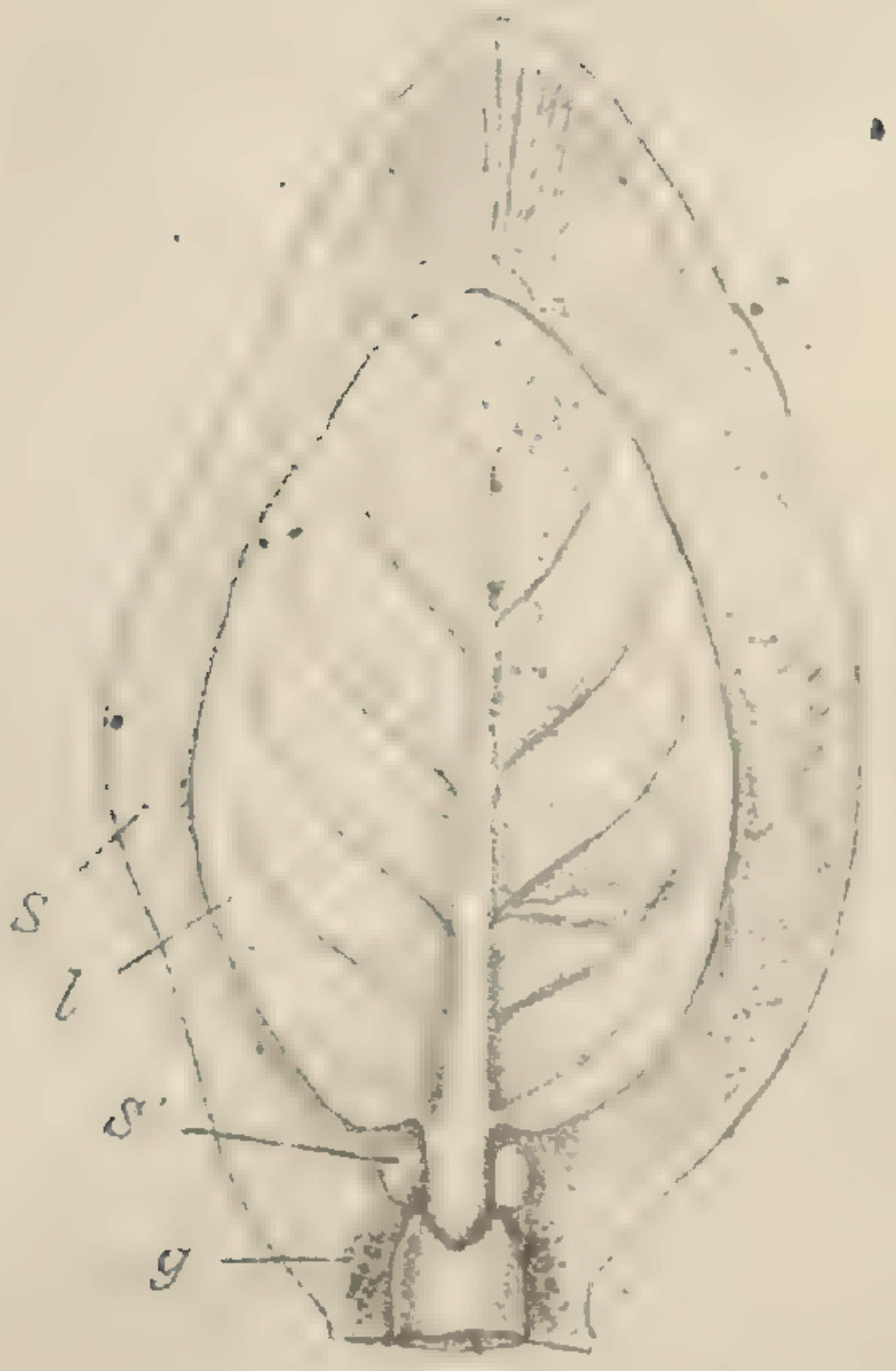
Fig. 27. Young shoot of ditto.

Fig. 28. Base of leaf-stalk of *Clusia rosea*, looked at from the side on which the opposing leaf has been removed ; shows the enclosed terminal bud enveloped in the secretion, which has been rendered opaque by alcohol.

Fig. 29. Young lateral bud in the axil of a leaf of ditto.

Figs. 30 & 31. Longitudinal sections of colleters of ditto.

Fig. 32. Bud of *Wormia Burbidgei* : *r*=region within which the younger parts are concealed ; *v.l.*= sheath of older leaf.



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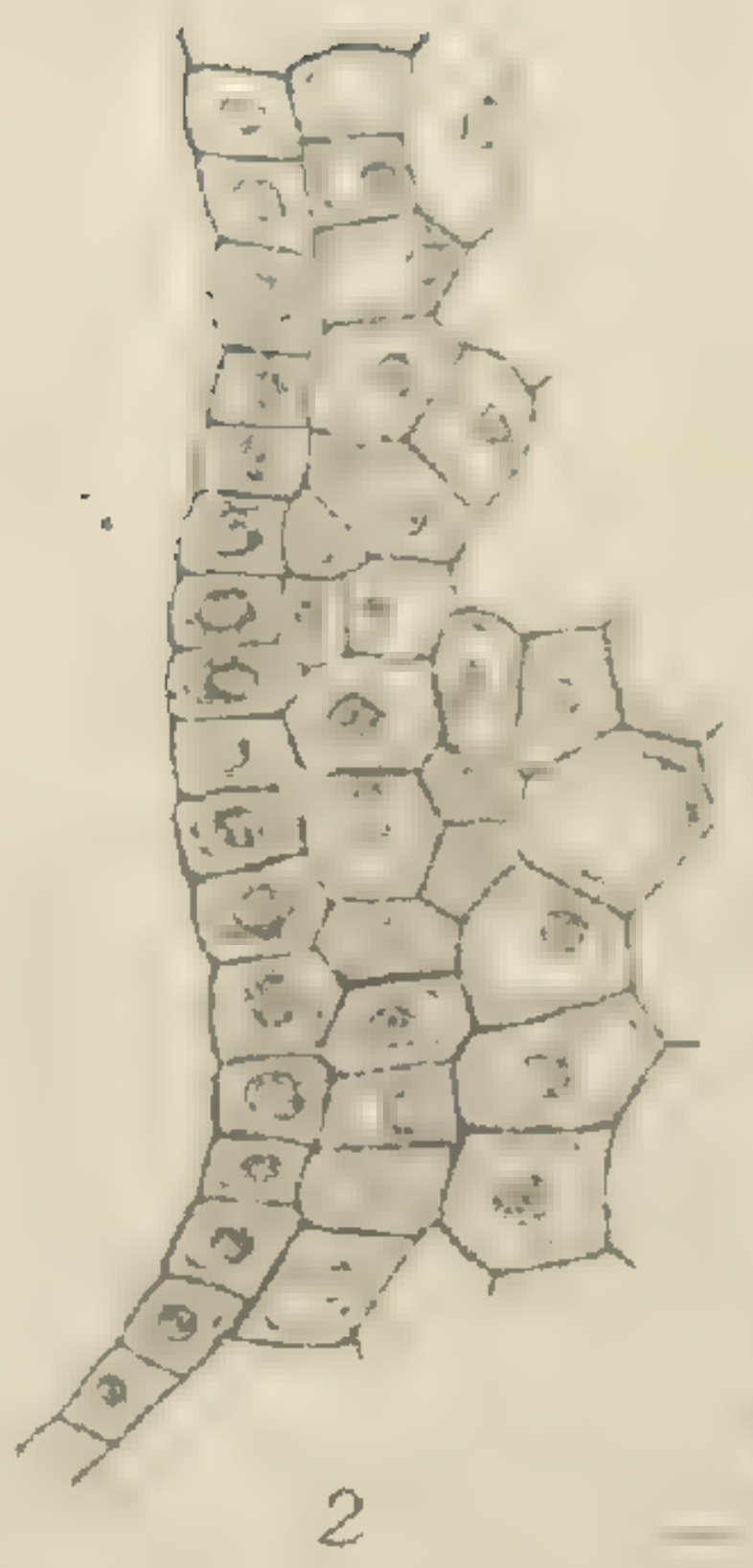

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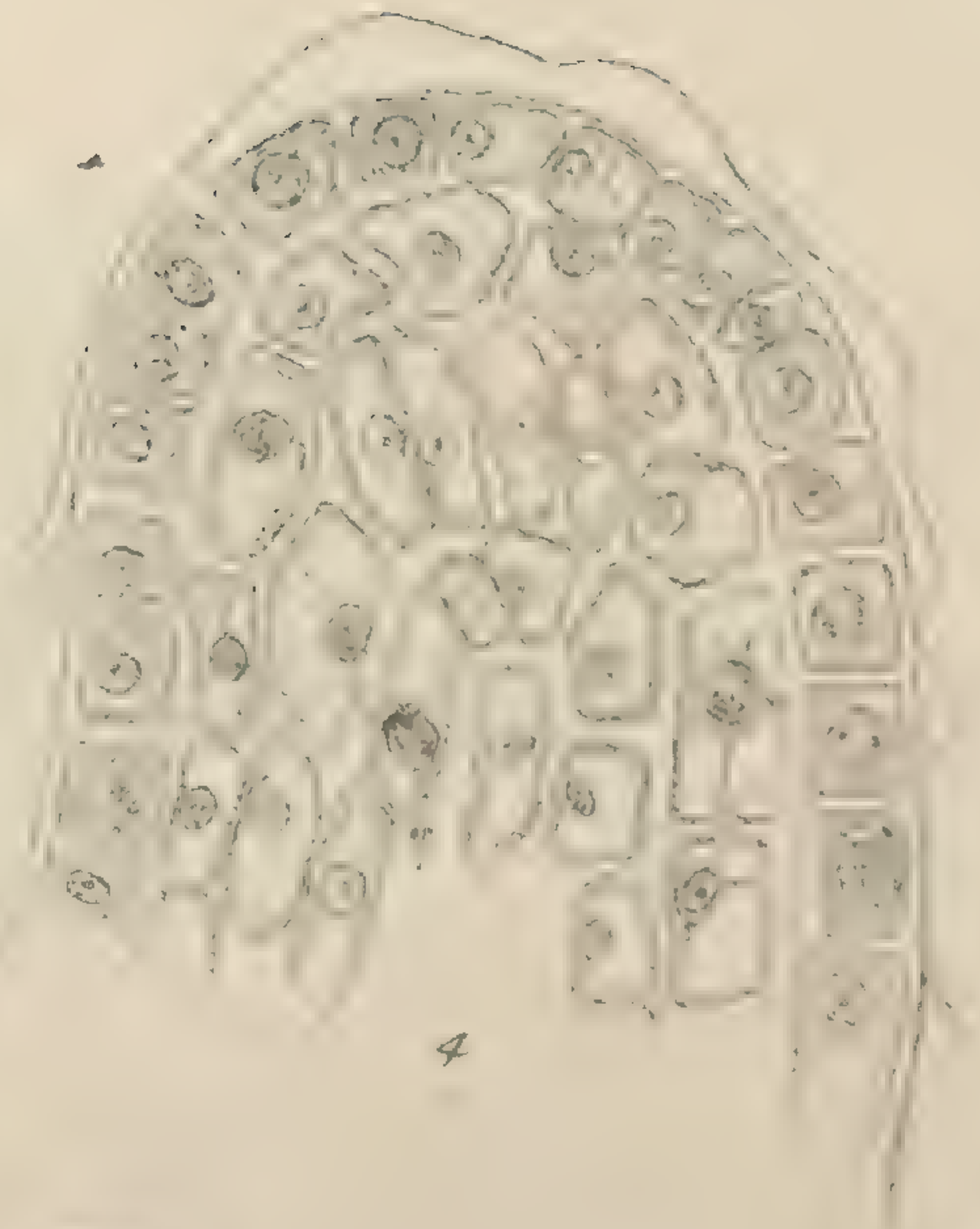

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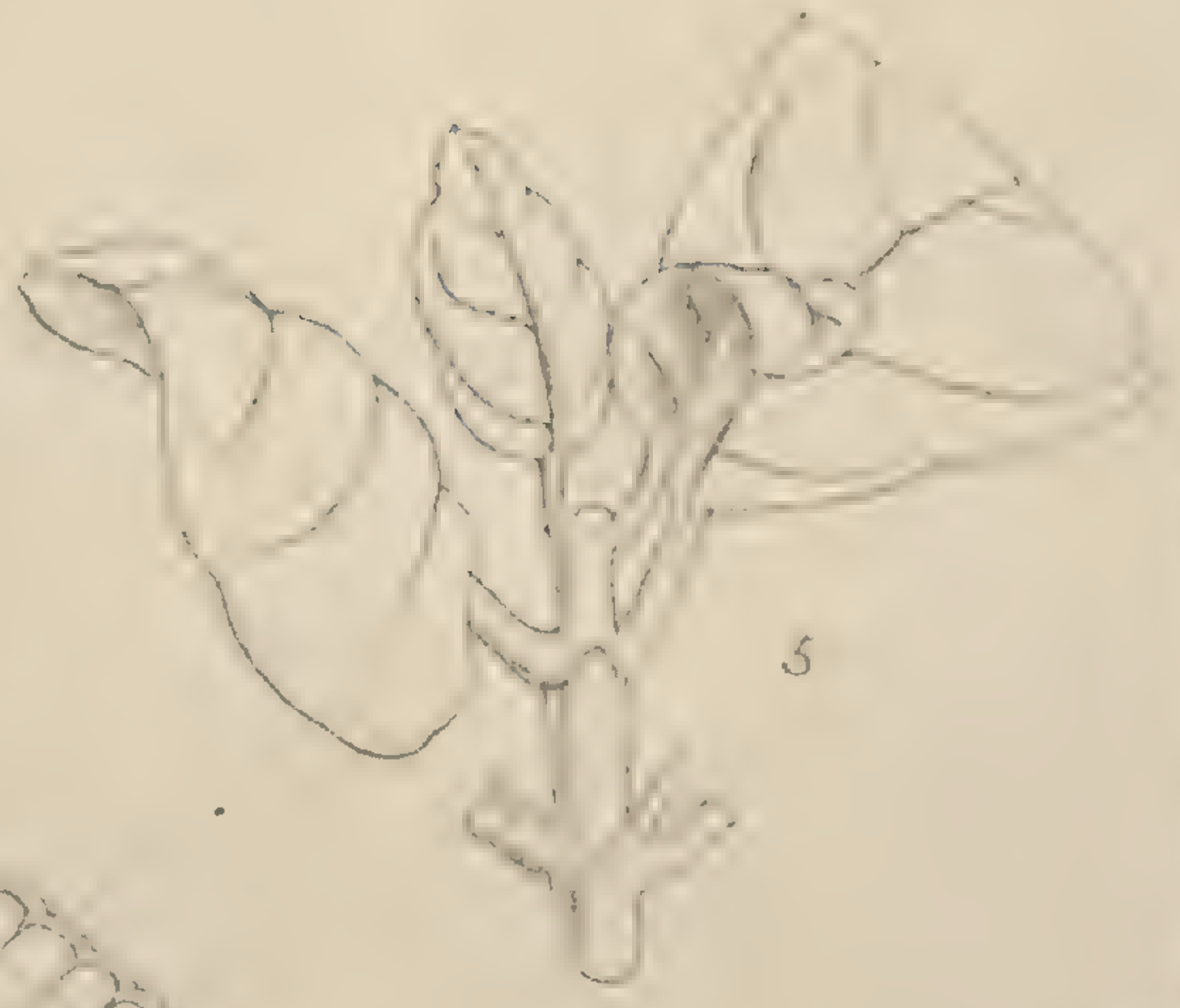

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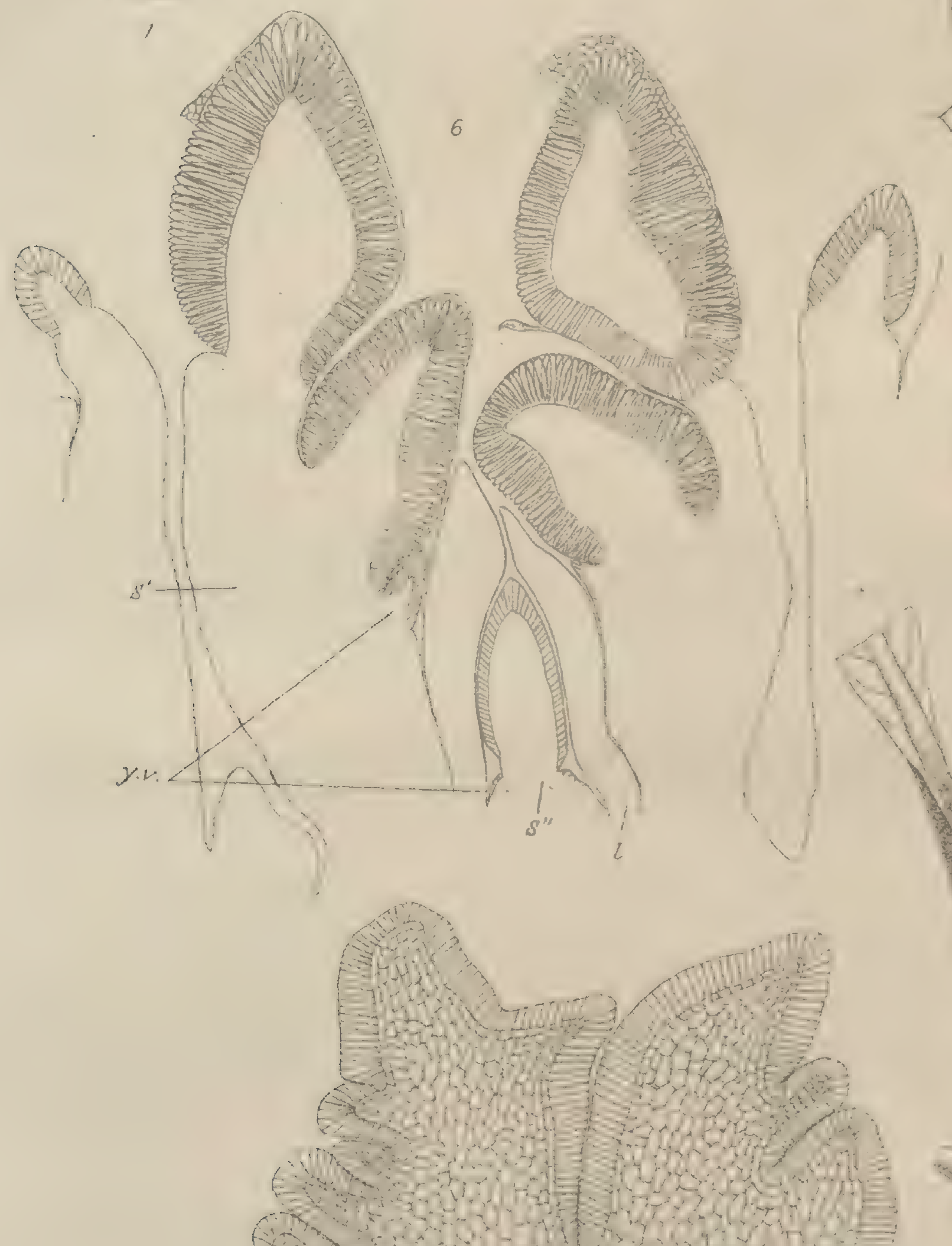

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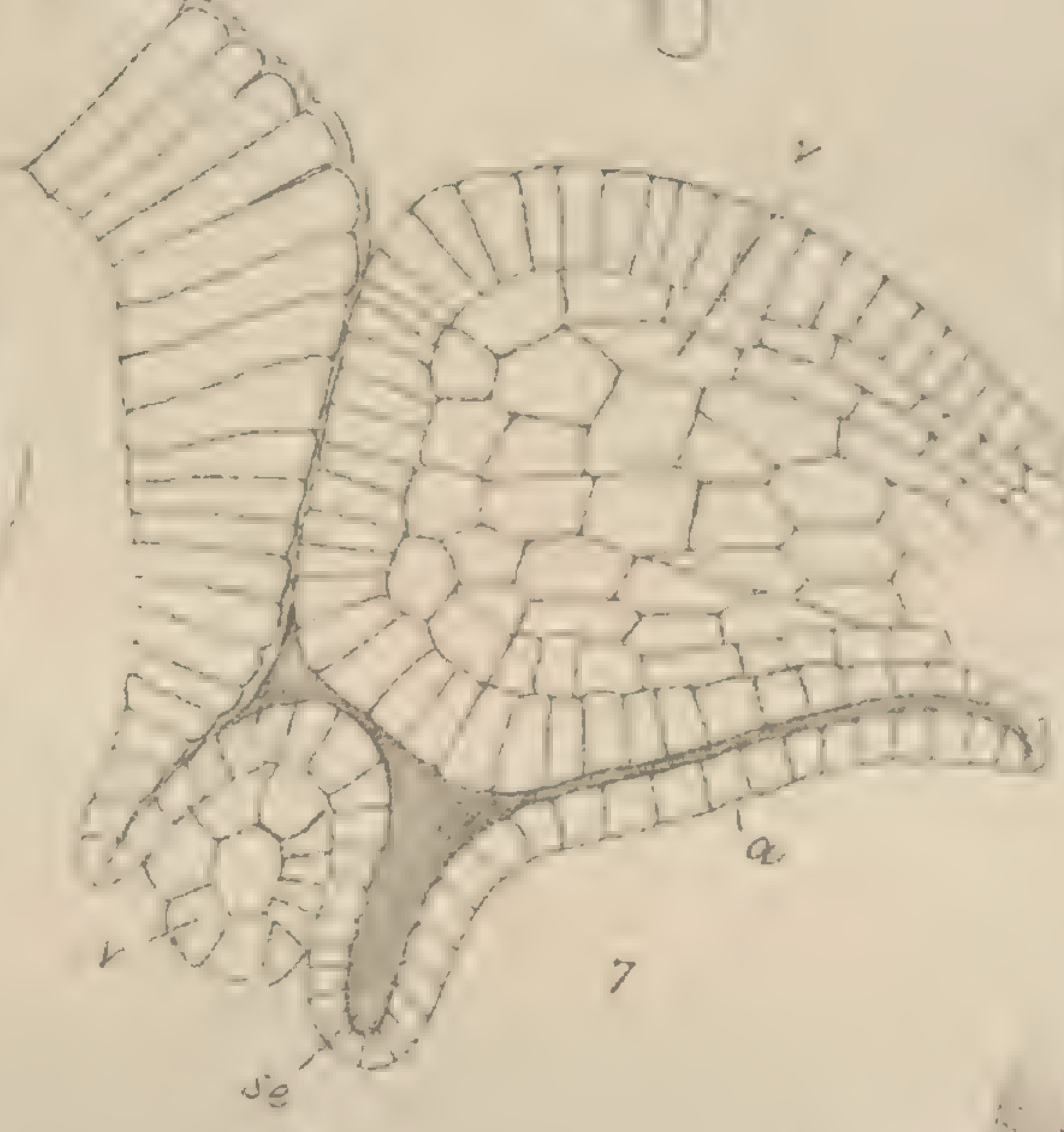

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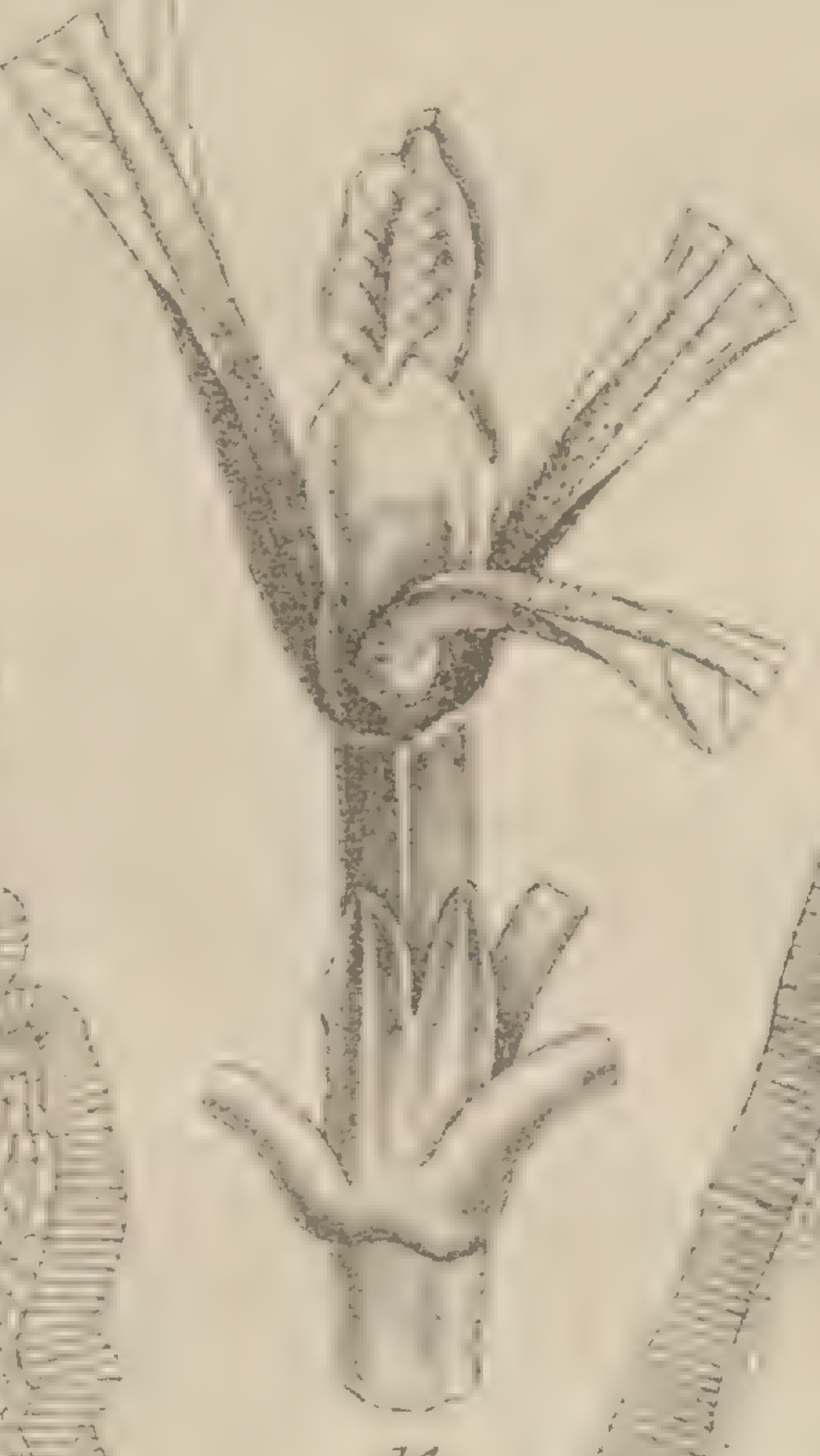

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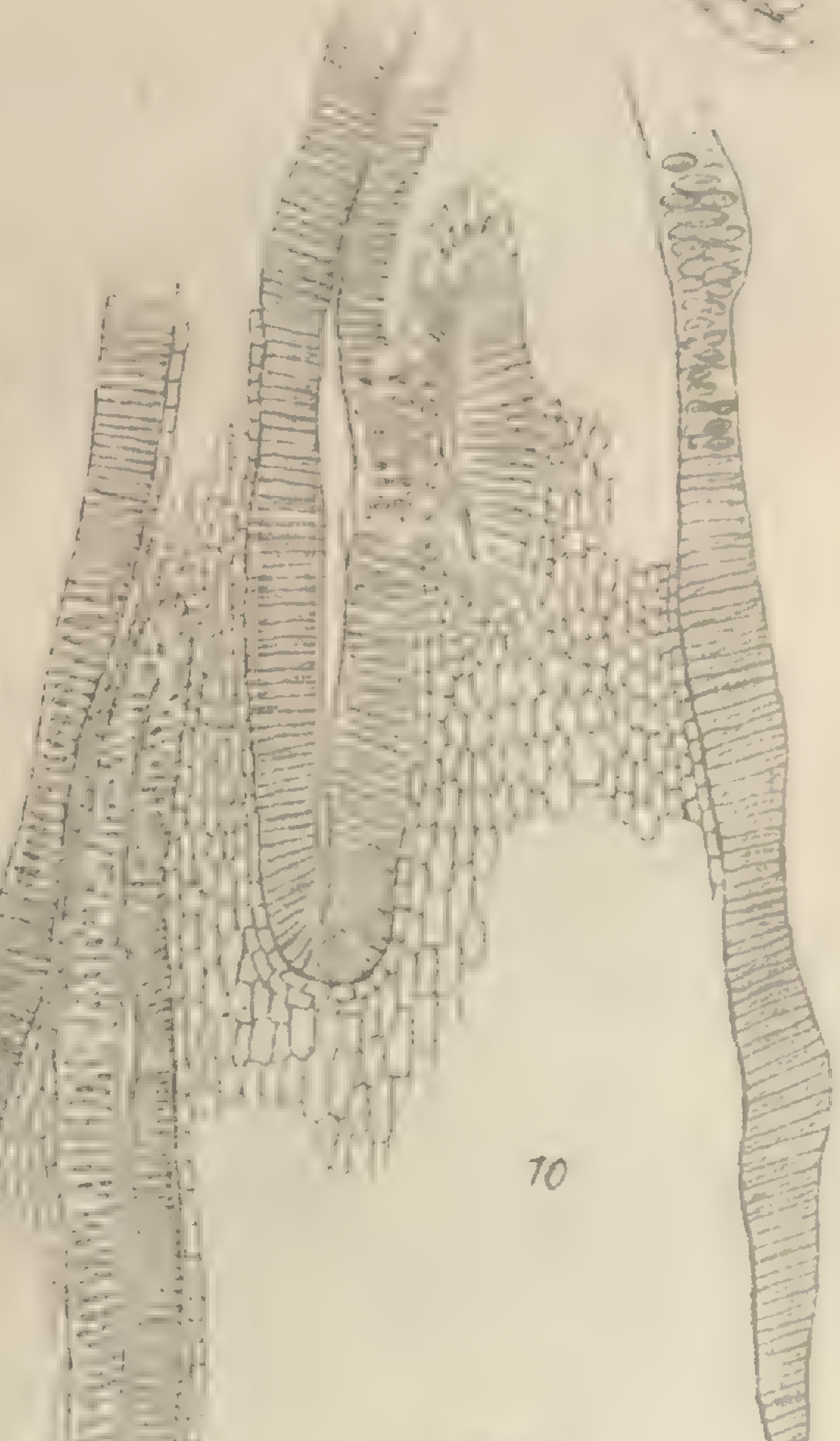

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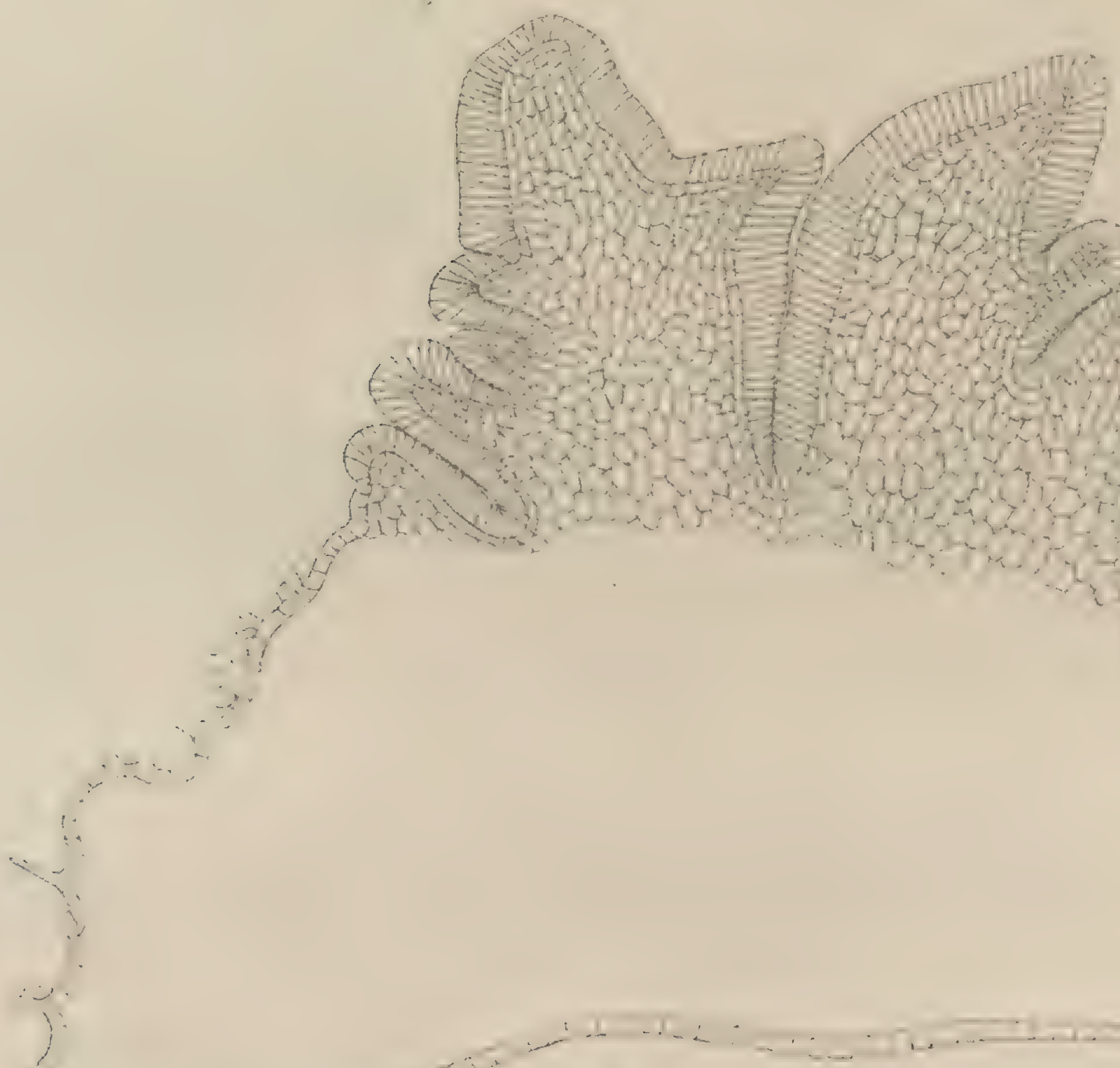

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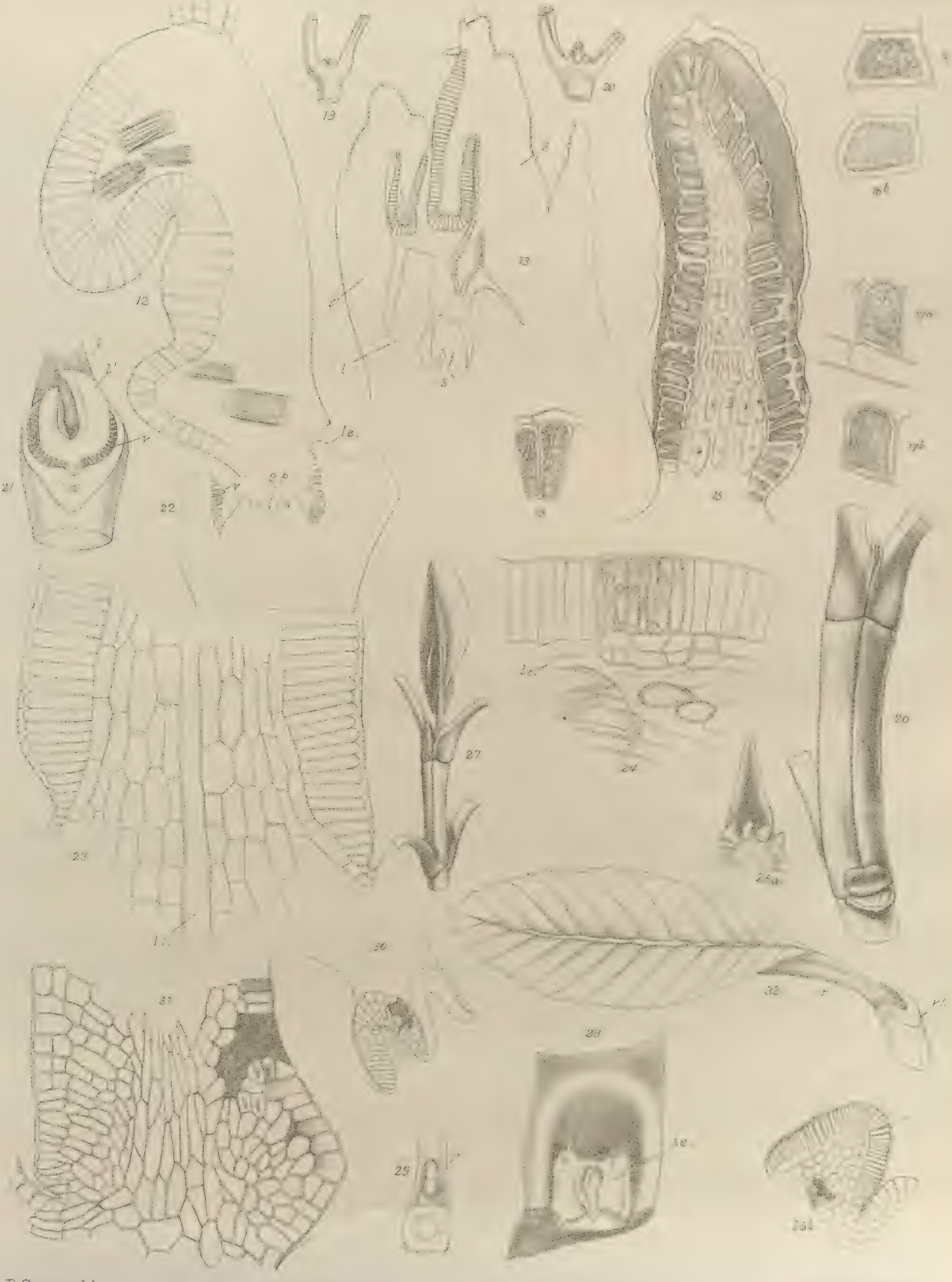
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	Part IV.	1883.	0	3	0	0	2	3
	Part V.	1883.	0	3	0	0	2	3
	Part VI.	1884.	0	13	6	0	10	0
	Part VII.	1884.	0	9	6	0	7	0
	Part VIII.	1884.	0	10	0	0	7	6
	Part IX.	1886.	0	7	0	0	5	0
	Part X.	1887.	0	3	4	0	2	6
	Part XI.	1886.	0	6	0	0	4	6
	Part XII.	1886.	0	8	0	0	6	0
	Part XIII.	1887.	1	7	0	1	0	0
	Part XIV.	1887.	0	7	0	0	5	0
	Part XV.	1887.	0	10	0	0	7	6
	Part XVI.	1888.	0	2	6	0	2	0
III.	Part I.	1888.	3	12	0	2	14	0
	Part II.	1891.	0	5	0	0	3	9
	Part III.	1891.	0	7	0	0	5	0
	Part IV.	1891.	0	6	0	0	4	6
	Part V.	1891.	0	6	0	0	4	6
	Part VI.	1891.	0	3	6	0	2	8
	Part VII.	1892.	0	6	0	0	4	6
	Part VIII.	1893.	0	6	0	0	4	6

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THE
TRANSACTIONS
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THE LINNEAN SOCIETY OF LONDON.

ON THE FLORA OF THE EASTERN COAST OF THE MALAY PENINSULA.

BY
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November 1893.

X. *On the Flora of the Eastern Coast of the Malay Peninsula.* *By* Henry N. Ridley, *M.A., F.L.S., Director, Gardens and Forest Department, Singapore.*

(Plates LXI.–LXVI.)

Read 2nd March, 1893.

THE eastern side of the Malay Peninsula has never hitherto, so far as I am aware, been visited by any botanist, and hence its flora has remained absolutely unknown. The researches of the earlier botanists Griffith, Wallich, Porter, Maingay, Scortechini, and the later collectors have been confined to the more accessible western side; for in the earlier days the eastern coast was not sufficiently opened up for travellers and collectors. During the past few years, however, I have been able to make some collecting-trips in this rich and interesting region, chiefly in the native State of Pahang; but I have also visited the more northern States of Kelantan and Tringganu, and also the island of Pulau Tiuman, lying off the coast of Johore.

The number of plants obtained enables me to give a fair representation of the lowland and coast flora, and of that of the subalpine woods of the Tahan district and of the limestone rocks of Kota Glanggi. The number of different species collected and seen during my explorations here exceeds 1200; but it must be remembered that this represents but a small proportion of the whole flora, as the opportunities of collecting during a rapid expedition such as that up the Tahan River are but limited, and further that a very large proportion of the trees and shrubs seen were not in flower or fruit at the time of my visit. I think it would be within the mark to say that the number of species existing in the area traversed is not less than three times that number.

I am indebted to Mr. C. B. Clarke for identifying the Cyperaceæ, to Professor Hackel for the Gramineæ, to Mr. Baker for the Vascular Cryptogams, and to Dr. King for many plants of various orders. A number of species still remain unidentified in the collection in the Singapore Gardens Herbarium. Of some the materials are inadequate, others belong to difficult and critical orders, such as that of the Rubiaceæ, of which there appear to be a very large number of species in the Malay Peninsula as yet undescribed, which, however, it will be necessary to compare with those of the Archipelago.

The Relations of the Pahang Flora.

Till the plants of other parts of the Malay Peninsula are known more thoroughly it is difficult to get any clear idea of the origin of the flora of the whole region or to break it up into floral provinces. There is, however, a very marked difference between the floras of Singapore and Pahang.

Many common plants of the southern portion of the Peninsula, and especially the secondary jungle plants, become scarce or disappear in Pahang; such plants are:

Adinandra dumosa, Miq., *Limacia velutina*, Miers, *Ficus alba*, Reinw., and *F. chrysocarpa*, Reinw., *Mappa javanica*, Blume, *Gironniera nervosa*, Planch., *Spathoglottis plicata*, Lindl., *Bromheadia palustris*, Lindl., *Dracæna Cantleyi*, Baker, and the many species of *Quercus* and *Castanopsis*. There is a large accession of Bornean types, such as *Isoptera*, *Neckia*, *Brugmansia*, and *Rhynchopyle*: but I am rather doubtful whether we should consider these as forming part of a distinct Bornean flora; I rather imagine them to be the relics of an older flora, common to the whole of this region. Thus *Rhynchopyle* occurs also in Gunong Pulai in Johore and in Perak, *Isoptera* in Perak, and *Neckia* in the island of Lingga and in Johore, and the greater number of the other plants which one might consider as Bornean types occurring throughout the peninsula belong to classes of plants (such as Orchids, Aroids, and Burmanniaceæ) which the ordinary collector too often neglects on account of some difficulty in preserving specimens.

General Aspect of the Flora.

The classes of floras which I have examined in Pahang may be arranged as littoral, mangrove, heath country, low jungle, and subalpine forest.

The littoral flora is well seen at Kwala Pahang, the mouth of the Pahang River. The seashore consists of a stretch of sand along which runs, above high-water mark, a single line of Ru-trees (*Casuarina equisetifolia*, Forst.), on the branches of which are many lichens and fungi, and a fine orange, *Loranthus*. These trees do not grow a hundred yards inland, but are confined to this single row. Beneath them the ground is carpeted with many grasses and sedges, *Ipomœas*, *Canavalia*, *Vigna*, &c. The most striking plants of this region are the porcupine-grass (*Spinifex squarrosus*, Labill.) and a beautiful prostrate blue-flowered *Vitex*, apparently a seashore form of *V. Negundo*, Linn., which inland forms a small tree. Bushes of *Pandanus*, *Crinum asiaticum*, Linn., *Eurycles amboinensis*, Labill., and *Tacca pinnatifida*, Forst., are also conspicuous in this region.

The mangrove-swamp, in this part of Pahang at least, is less extensive than in most parts of the Peninsula, on account of the sandy character of the country, as the rivers do not bring down the mud suited to the mangrove flora. But here and there are patches of mangrove-swamp, as at Sungei Meang, where there are the common species of *Bruguiera*, *Sonneratia*, *Lumnitzera*, *Acanthus*, *Tristellateia*, &c.

Coming up the river towards Pekan, the capital of Pahang, we pass into the great heath district, which consists of open flat country, very sandy, dotted over with thickets and clumps of bushes, alternating with grassy patches. Here are very many grasses and sedges of much interest, together with *Xyris*, *Drosera*, *Mitrasacme*, and in damper spots white, pink, and yellow *Utricularias*, *Limnanthemum*, *Vandellia*, *Bonnaya*, and many other small herbs.

Among the bushes or trees are *Eugenias*, *Rhodomyrtus*, *Ilex*, two species of *Vaccinium*, *Olea maritima*, *Choriophyllum*, *Ficus* of several species, *Cyrtophyllum fragrans*, *Fagræa racemosa* and *obovata*, and *F. auriculata*, with its huge white trumpet-shaped flowers.

Many ferns and *Loranthi* grow on these bushes, and some small orchids are abundant, including *Bulbophyllum Restrepia* n. sp., *Cirrhopetalums*, *Dendrobium pumilum*, Lindl., and *D. secundum*, Lindl., *Eria bractescens*, Lindl., *Acriopsis*, &c., while a fine white-flowered *Renanthera* scrambles over and through the bushes.

On the right bank of the river at Pekan the country is more swampy and less sandy. Large tracts are covered with *Saccharum Ridleyi*, Hack., and great tufts of "Palas" (*Licuala spinosa*, Griff.), and there are many pools full of *Nelumbium Lotus*, Linn., and in drier places *Clerodendron Siphonanthus*, Linn., and a small species of *Crinum*, perhaps *C. defixum*, Herb., are abundant. The river-banks in many places are clad with dense thickets hanging down to the water's edge, interspersed with trees of *Lagerstrœmia*, the pink-flowered *Cassia nodosa*, and golden *C. siamea* and *Millettia atropurpurea*, which, with great masses of orange and red *Bauhinias* and clumps of white-flowered *Clinogyne*, make this district very beautiful.

The next distinct flora is that of the Kota Glanggi limestone rocks in the woods of Pulau Tawar. This region produces many plants not met with elsewhere in Pahang, but occurring also in a similar locality in Kwala Lumpur in Selangor; such are: *Procris Epithema*, *Begonia*, *Elatostemma*, and *Saraca cauliflora*, Baker, a tall slender tree with great trusses of orange-yellow flowers and large pink pods. Among the most important discoveries in this locality were *Protamomum*, a new genus of Musaceæ, *Pomazota*, a new genus of Rubiaceæ, the curious *Trichopus zeylanicus*, hitherto only known to occur in Ceylon and Southern India, a fine *Didymocarpus* (*D. quinquevulnerus*) with white flowers tipped with crimson, a remarkable *Geophila*, and many orchids.

The woods at the mouth of the Tembeling River (Kwala Tembeling), where it unites with the Pahang River, produced an abundance of interesting plants, but none more so than *Brugmansia Zippelii*, the first Rafflesiad recorded from the Malay Peninsula, though I have since seen specimens of a species of *Rafflesia* collected by Mr. Wray in Perak.

Passing up the Tembeling River we begin to meet with the first traces of the sub-alpine flora of the Tahan River, and on entering the valley of that stream we find ourselves in a totally distinct flora. The rocky banks of the river are clad with a dense forest of trees and shrubs, the most conspicuous of which is an undescribed species of *Dipterocarpus*, bright at the time of our visit with its pink fruit, or scenting the air with its large pinkish cream flowers. Its boughs were loaded with *Cœlogynes*, *Dendrobiums*, and many other orchids, including *Grammatophyllum speciosum* in magnificent flower.

The hills which enclose the rocky stream are upwards of 2000 feet altitude, and composed of quartzite, clad to the top with tall trees. One could not but be struck by the similarity in form of the foliage of the chief plants which grew close to the water's edge. There was here quite a series of plants with peculiarly long, narrow, acuminate leaves, such as the specific name *salicifolia* suggests. They belonged to all manner of orders, and included a *Calophyllum*, an *Ixora* (*I. stenophylla*, Miq.), a *Hygrophila* (*H. saxatilis*, n. sp.), an *Antidesma* (*A. salicifolia*, Miq.), a *Didymocarpus* (*D. salicina*, n. sp.), a new genus of Asclepiadeæ (*Spiladocorys*), a *Podochilus* (*P. Maingayi*, Hook.), a *Ficus* (*F. pyriformis*, Hook.), a *Rhynchopyle*, and a *Melastoma*.

The forms of leaves in the tropical woods bear a great relation to the amount and force of the rainfall. During a tropical shower it is easy to see how well the commonest form of jungle-leaf (a lanceolate acuminate or caudate one) is adapted for throwing off the heavy rainfall rapidly. But the form of the narrow leaf among the plants mentioned above seemed to me to be the result of adaptation to avoid another danger.

All these plants grow on rocks close to the water's edge, and as the river is subject to very rapid rises from sudden falls in the mountain districts, these plants are liable to submersion in a violent rush of water. Broad foliage would be torn off or mutilated, but narrower leaves, offering a less resistance to the water, would receive no injury. One may compare with this the narrow floating leaves of the aquatic *Ranunculi* and Potamogetons which inhabit the rapid streams in Europe.

The islands of the Tahan River formed of boulders produced several interesting plants, including *Homonoia*, not hitherto recorded south of Siam, a curious new and shrubby *Phyllanthus*, and abundance of the beautiful orchid *Arundina speciosa*, Blume.

Many smaller streams run down from the sides of the hills to join the main river, and in their ravines were Begonias, Aroids, *Didymocarpi* of all colours, and the curious *Gomphostemmas*, resembling the European *Lamium* and *Galeobdolon*, and many Scitamineæ.

The soil of these woods is very sandy in many parts and it is probable that to this cause the paucity of *Termites* is due. They were certainly much less abundant than they are in the woods in the island of Singapore and the southern part of the Peninsula generally. Owing to this the leaves and sticks on the ground decayed slowly and formed a richer soil, while in the woods on clayey soil, where white ants are abundant, the vegetable fragments are rapidly eaten by them as they fall and are rendered useless for soil-fertilization. The *Termites* are unable to live in sandy soil, because they cannot make their subterranean nests in sand, which would fall in, whereas in the stiffer clay they can easily make the dome-shaped chambers and passages.

The upper woods of the Tahan River were very wet, rain falling heavily every night. The ground was permanently sodden, and at night glowed brilliantly with the luminosity —probably Bacterial—of the decaying leaves. At the furthest point to which the expedition attained, a fair-sized stream entered on the right bank of the main river, and here the trees were covered thickly with wet moss, in which grew many orchids, including a new species of *Phalænopsis* allied to *P. sumatrana*, a beautiful orange-flowered *Dendrobium*, *Cœlogynes*, and *Erias*. In the muddier spots were many fine Scitamineæ; *Phryniums* of two species, *Globba*, *Curcuma*, *Amomums*, and *Zingibers* were obtained. In the drier upper part of the hills grew the beautiful palm called by the natives "Daun Payoh" (umbrella-leaf), the *Teysmannia altifrons*, Miq.

Jungle-products.

The dense jungles of the Tahan River produce a good quantity of Rattans of many species, but in the more accessible country along the banks of the Tembeling and Pahang Rivers, the better class of Rattans have been almost exterminated and little is left but the inferior ones, especially *Calamus crinitus*, Blume.

Of Dammar-trees the "Minyak Krueng" (*Dipterocarpus pterygocalyx*, Miq.) and a few other species are abundant. Gaharu-wood (*Aquilaria malaccensis*, Hook. f.) is collected by the Sakais (the aborigines of this region) and sold to the Malays. I met with the tree in fruit in the Tahan woods.

Gutta-trees are plentiful in the Tahan districts, and Pahang gutta-percha has a very high value in the market. It is produced by *Dichopsis Gutta*, Benth. & Hook. f., *Dyera costulata*, Hook. f., producing the "Getah Jelutong" of the Malays; a gutta chiefly used for adulteration was also abundant, and there were many big lianes of "Getah Grip" (*Willughbeia edulis* and *W. Burbidgei*).

Bamboos are abundant on the edges of the river in many places, and were convenient for making rafts, on which jungle-produce is floated down to Pekan, where also they find a ready sale, as bamboos are scarce in the low country.

Cultivation.

The amount of cultivation in Pahang is very small. The natives are indolent and prefer a hand-to-mouth existence, although the soil in many parts of the country is exceptionally good and very superior to that of the south of the Peninsula. In the villages along the main river, Maize, Tapioca, Sago, Hill Paddy, and fruit are chiefly cultivated; I have also seen Italian Millet (*Setaria italica*) at Pulau Tawar.

The Penghulu Rajah of Tembeling (chief of that district) had some very healthy young Arabian coffee-trees in his garden quite free from *Hemileia vastatrix*; but he was entirely ignorant of the use of the coffee-berries, using the leaves only to make a kind of tea. Mr. Hugh Clifford, Acting Resident of Pahang, informs me that there are plantations of gambir further up the Tembeling River than I have been, which have been in cultivation for some generations; but gambir for chewing only is made and is not exported.

A small quantity of copra is now being made in Pekan by the Chinese, and coconut-sugar is also made there.

Of fruits the usual Malay kinds are commonly cultivated, and the trees often persist long after the villages have been deserted and swallowed up in jungle. Durian (*Durio zibethinus*, Linn.), Mangosteen (*Garcinia Mangostana*, Linn.), Asam Gelugur (*G. atroviridis*, King), Rambutan (*Nephelium lappaceum*, Blume), Pulasan (*N. mutabile*, Blume), Langsat (*Lansium domesticum*, Jack), Bananas, Rouminia (*Bouea microphylla*, Griff.), Kadondong (*B. macrophylla*, Griff.), and Carambola (*Averrhoa Carambola*, Linn.) are all plentiful.

Many of these fruit-trees are to be found a long way in the jungles, far from cultivation, but I am inclined to think that they are not natives here. In some cases they may be the relics of villages which have disappeared, but many are evidently derived from seed scattered by the wandering Sakais or by monkeys. Round the encampments of the aborigines known as Sakais, one could often find the remains of Durians and Rambutans, the seeds of which were germinating. These savages, like monkeys, swallow the fruit without ejecting the seed, and pass the seed unharmed at some distance from the place whence they took the fruit, and thus scatter the seed all over the forests. Two other plants, apparently not indigenous, had been carried up the Tahan River for a considerable distance and appeared at spots on the river-bank where there were signs of encampments; these were *Colocasia antiquorum*, Linn., and *Justicia Gendarussa*, Linn. f. The latter never produces seed here, and I doubt much its being indigenous; it is used as a medicine, and a piece or two of the stem may have been brought up here by some Malay in pursuit of jungle-products and dropped here.

The Tampoi (*Baccaurea malayana*, King), the Tamponet (*Artocarpus rigida*, Blume), the Champedak (*A. polyphemia*, Miq.), and the Rambutan Pachat (*Xerospermum Noronhianum*, Miq.), less often cultivated, are indigenous to these woods.

Another eatable fruit found wild in the Tahan forests was that of the Akar Panti, a climber with a large somewhat apple-shaped fruit, with the smell and taste of a good apple. I was unable to procure adequate specimens to make out even the order of this plant.

In the Kota Glanggi woods (Pahang River) the ground was strewn with the pulpy covering of a large spindle-shaped triquetrous seed of a lofty tree known here as "Drija." It is much sought for the kernel, which is eaten and which also produces much oil. The tree was too tall to obtain specimens of the foliage; it was possibly a *Canarium*.

The short glimpses of Tringganu and Kelantan which I have had were insufficient to give any idea of the extent and nature of the cultivations, but these provinces are very superior in this respect to Pahang. Extensive tracts of coconuts fringe the Tringganu River, while the low swampy country at the mouth of the Kelantan River supplies much rice, and buffaloes are largely bred. A better style of garden-cultivation may be noticed in the villages, a more varied stock of plants being kept. I observed a species of *Amorphophallus* planted here in rows for the sake of its tubers, eaten when cooked.

NOTE.—In the following list of localities "Kwala" signifies the mouth of a river—as Kwala Tahan, the spot where the River Tahan opens into the Tembeling River. "Pulau" is an island, and all mentioned here (except Pulau Tiuman) are small islands in the rivers.

POLYPETALÆ.

DILLENIACEÆ.

DELIMA SARMENTOSA, Linn.

Climbing shrub, with panicles of white flowers opening in the early morning and withering soon. The common variety is var. *hebecarpa* with pubescent fruit. The seed is black with a crimson fimbriate arillus.

Common along the river-banks of the Pahang and Tembeling Rivers.

TETRACERA ASSA, DC.

Common along the river-banks with the last. Pahang and Tembeling Rivers.

On the sea-shore at Kwala Pahang it forms bushes, but it is more usually a climber. The flowers are white, tinted with pink. The seed has a crimson fimbriate aril. It also occurs in Tringganu.

T. MACROPHYLLA, Wall.

Pekan.

ACROTREMA COSTATUM, Jack.

Abundant in the woods on the Tahan River; almost carpeting the ground in some spots.

DILLENIA INDICA, Linn.

A big tree on the river-bank at Pulau Tawar. Flowers white.

D. OVATA, Wall.

I believe I am right about this fine tree, though I identify it only from description. It is a fair-sized, much-branched tree, with large yellow flowers. The fruit, which has not been described hitherto, is that of a true *Dillenia*, covered with the fleshy enlarged sepals, and containing a number of very small black seeds in a glutinous slimy pulp. The seeds are exarillate.

It is a beautiful plant occurring in the open jungles at Pulau Chengei, Tembeling, and Tahan Rivers.

WORMIA SUFFRUTICOSA, Griff.

By no means as common as in Singapore; only seen at Ayer Hitam, near Pekan.

Dr. King (in 'Materials for the Malay Flora') mentions this as a small tree; here, however, it is rather a large bush with many stems. *W. oblonga*, Wall, on the other hand, forms a fine tall tree, and when covered with its beautiful yellow blossoms is a splendid sight. Both these species inhabit damp swampy ground.

W. PULCHELLA, Jack.

A small tree, very inferior in beauty to the others. Not very common anywhere. One tree found in open country at Kwala Pahang.

W. OBLONGA, Wall.

"Pinang Purgam" of the natives. Temerloh; Passir Loyang.

ANONACEÆ.

UVARIA MACROPHYLLA, Roxb.

A tree with red flowers. Pekan.

U. RIDLEYI, King.

A low shrub, growing in open country, with small purplish flowers and sweet pulpy eatable fruit, called "Ladak" by the natives.

Pekan, Kalambalai, Kwala Berar.

ANAXAGOREA SCORTECHINII, King.

A small tree. Tahan woods.

I have this also from Sungei Ujong, where it is called "Poko Guring."

A. LUZONENSIS, A. Gray. Kota Glanggi.

XYLOPIA FERRUGINEA, Hook. f.

Woods at Pekan.

ELLIPEIA NERVOSA, Hook. f.

Flowers white. Tanjong Antan.

Goniothalamus macrophyllus, King.
Kwala Tenok.

Polyalthia Kunstleri, King ?
Sungei Tahan.

P. Beccarii, King.
Kota Glanggi.

Popowia ramosissima, Hook.
Kota Glanggi.

Unona desmos, Linn.
Temerloh. Kelantan at Kamposa.

U. dasymaschala, Blume.
Pekan. Kelantan at Kamposa.

Orophea maculata, Scort. Pulau Chengei, Kota Glanggi.

MENISPERMACEÆ.

Fibraurea chloroleuca, Miers.
Woods in Pekan and at Kwala Pahang. Not seen higher up.

A very common plant in Singapore, where it is called "Akar Kuning" (yellow root), the root producing a yellow dye.

Pericampylus incanus, Miers.
Thickets near Pekan.

Cissampelos Pareira, Linn.
Pulau Rumput, Pahang River.

Stephania hernandifolia, Walp.
Pulau Rumput, growing mixed up with the last species.

Limacia Kunstleri, King.
Sea-shore and near the mouth of the river. Kwala Pahang.

I have also found this pretty species near Changi, in Singapore. It is remarkable in its being laticiferous like *Tinospora*.

NYMPHÆACEÆ.

Nelumbium speciosum, Willd.
Swamps and rice-fields along the Pahang River, at Mahang and Temerloh. No doubt wild here. It is, however, commonly cultivated all about the Peninsula.

Nymphæa stellata, Willd., var. **versicolor**.
Lake Chenei (*W. Fox*).

CAPPARIDEÆ.

Cleome viscosa, Linn.
Common on sandbanks and islands of the Pahang and Tembeling Rivers.

Gynandropsis pentaphylla, DC.
Near Pekan, at Pulau Tawar, and Kwala Berar. In waste and cultivated ground.

ROYDSIA PARVIFLORA, Griff.

Flowers white. Kwala Tembeling.

CRATÆVA ROXBURGHII, R. Br., var. NARVALA.

A fair-sized tree with large leaves, glaucous beneath, and big, rough, greyish-green fruits. At Pulau Rumput on the Pahang River, and on an islet in the Tahan River.

VIOLACEÆ.

ALSODEIA ECHINOCARPA, Korth.

A large bush, more rarely a tree. Very common in Pahang, also at Pulau Tawar and Tanjong Antan.

A. MEMBRANACEA, King.

A little way up the river above Pekan; collected by Dr. Haviland.

A. KUNSTLERIANA, King.

Tanjong Antan, Pahang River.

NECKIA HUMILIS, Hook.

Tahan woods by the river; very local.

The genus has not hitherto been recorded except from Borneo. I have recently, however, received specimens of another species from Lingga Island, and of the above-named one from Gunong Janeng (2000 feet alt.) in Johore.

BIXINEÆ.

BIXA ORELLANA, Linn.

Cultivated here and there, and half wild in many places.

SCOLOPIA RHINANTHERA, Clos.

Near Pekan. A straggling thorny bush with greenish flowers.

FLACOURTIA RUKAM, Zoll. & Mor.

Common in thickets round Pekan. The plant most frequently cultivated is *F. cataphracta*, Roxb., and this is the species really known as "Rukum," and gives the best fruit.

PANGIUM EDULE, Reinw.

A big tree on the river-banks at Kwala Tembeling. The fruit was quite smooth and brown, not spotted with white as Blume figures it. It is called "Payung" or "Kapayung" by the natives. The oily seeds are pounded and the oil used in medicine, &c.; but it is also used for attracting fish, in the form of a dark brown odorous substance, a small quantity of which is thrown into the water and stirred about, and in a few minutes the fish come to the spot. A native who possessed a bamboo-full threw some into a deep hole in the river, and on firing a charge of dynamite shortly afterwards, we obtained a large quantity of fish.

HYDROCARPUS CASTANEA, Hook. f.

Banks of the Tahan River. Fruiting specimens only were found, which I think belong to this species, but the fruits were much larger (3 inches long) than described by Dr. King. The foliage is, however, exactly similar.

RYPARIA SCORTECHINII, King.

Tahan woods. A small tree, very striking, from the long pendulous racemes of velvety-black angular fruits.

R. FASCICULATA, King.

Pulau Tawar woods; also Pulau Chengei.

This is called "Tajam Bulat" or "Panchow" by the natives. The tree much resembles a Rambai (*Baccaurea Motleyana*, Hook.), producing on its stem long racemes of globose-triquetrous fruits about an inch and a half long and about the same in thickness. The skin is thin and pale buff, and encloses three seeds enclosed in a white pulp of very excellent flavour, superior, in fact, to that of the Langsat, which it much resembles. As a fruit it was not relished by the Europeans at least, on account of its possessing decidedly purgative qualities.

PITTOSPOREÆ.

PITTOSPORUM FERRUGINEUM, Ait.

Sea-shore at Kwala Pahang.

A small bushy tree with white flowers and orange fruits. A typically sea-shore plant, occurring commonly in Singapore, Carimon Islands, &c.

POLYGALEÆ.

POLYGALA VENENOSA, Tuss.

Woods opposite Pulau Tawar. This is common in the woods of the hill districts near Thaiping, in Perak.

P. BRACHYSTACHYA, Blume.

Grassy bank of river Pulau Tawar. A small prostrate herb with yellow flowers.

SALOMONIA APHYLLA, Griff.

Paths through the woods, Kota Glanggi. Always a local and scarce plant. I have collected it in Malacca and Singapore also.

XANTHOPHYLLUM, sp.

A tree; leaves when dry light fawn-colour, above shining, beneath reticulate and paler, lanceolate, shortly petioled, 4 inches long, $1\frac{1}{2}$ broad. Fruit globose, smooth, green when fresh, dusky brown when dry, about 1 inch through (not quite ripe). Seeds 2.

Kwala Mahang, on the Pahang River.

I cannot find any description to fit this plant, nor have I elsewhere seen it; but till flowers are seen one cannot be certain even of its affinities.

PORTULACACEÆ.

PORTULACA OLERACEA, L.

Common weed. Pekan, Kwala Tembeling; Temerloh, round the police stations.

TERNSTRŒMIACEÆ.

ADINANDRA MACRANTHA, Teysm.

Passir Loyang, Pahang River.

A., sp.

Pekan. A single specimen obtained.

Small tree, with leaves nearly a foot in length and four inches across; edges faintly denticulate, oblong acuminate, base cuneate; petiole thick, nearly an inch long. Leaves dry dark brown. Peduncle terminal, fairly slender, 1½ inch long. Sepals oval, blunt, glabrous, fleshy; margins scarious, minutely denticulate. Style long and slender.

I cannot match this with any of the glabrous-flowered species; the leaves are remarkably large. There was but one flower on the only tree I ever saw. It is, perhaps, a variety of the preceding species.

EURYA ACUMINATA, DC.

Common. Near Pekan, banks of River Tahan. Flowers white, berries black. Very variable here.

SARAUJA TRISTYLA, DC.

Pulau Chengei. Flowers rose-colour.

S. **NUDIFLORA**, Blume.

Tahan woods. Flowers white.

PYRENARIA ACUMINATA, Planch.

Small tree. Kwala Tembeling.

TERNSTRŒMIA PENANGIANA, Choisy.

Sea-shore, Tringganu.

GUTTIFERÆ.

GARCINIA HOMBRONIANA, Pierre.

This is a tree resembling in appearance the Common Mangosteen, *G. Mangostana*, and the flowers are dark red. The fruit is of the shape of a Mangosteen, but smaller, with a thinner rind of a bright red colour. The pulp, though rather acid, has a far finer flavour than that of the best Mangosteen, somewhat peach-like, and the scent of a ripe apple. It is, however, scantier than that of the cultivated species.

It grows in sandy spots at Kwala Pahang and Rumpin River, and I have also met with it at Blakang Mati Island, off Singapore, and in two places in Malacca, one of which was Jasin in the interior. In all the other spots it grows near the sea.

G. **KUNSTLERI**, King?

A small tree with foliage much like that of typical *G. Kunstleri*, King, but with the veins more distant. Fruit globose, depressed, of a deep crimson colour, with a thin rind, about an inch and a half in diameter. Calyx persistent. Stigma hardly raised, consisting of a small irregular collection of papillæ, yellow when dry. Seeds few, enclosed in a sweet eatable pulp. Skin of fruit bitter.

Banks of Tahan River, near Kwala Tenok.

GARCINIA NIGRO-LINEATA, Planch.

Kwala Berar. This is the plant known as "Kandis" by the natives.

The fruit, which is often produced in very large quantities, is excellent. It is about the size of a large cherry and of a light orange colour. The pulp of the seeds is very refreshing. The tree is usually a small one, and is very common in Singapore. The flowers are bright yellow. It is possible that there may be two or three species combined under this name; but I am more inclined to think it is one very variable species.

G. ATRO-VIRIDIS, Griff.

The well-known Asam Gelugur is cultivated or half-wild at Temerloh and elsewhere. Its fruits, which make a most excellent preserve, are sliced and dried in the sun by the Malays and sold in many parts of Pahang as elsewhere, but it is very little known to European residents. It is a handsome small tree, with bright red shoots and dark green old leaves, dark crimson flowers, and large, yellow, grooved fruits.

G. MANGOSTANA, Linn.

Is cultivated in most of the villages.

KAYEA (perhaps K. WRAYII, King) was collected in fruit only at Ayer Hitam near Pekan.

K. NERVOSA.

Sungei Chenei (*W. Fox*).

CALOPHYLLUM INOPHYLLUM, Linn.

A common sea-coast plant all over the Peninsula. It grows at Kwala Pahang.

C. CANUM, Hook.

Pekan.

C. RUPICOLUM, n. sp. Arbuscula, ad 6-pedalis, multiramosa, foliosa. Rami juvenes quadriangulati pallidi. Folia coriacea, haud nitida, angusta, lanceolata subacuminata, ad basin attenuata, atro-viridia (siccata pallida), venis approximatis utrinque prominulis, costa conspicua, 2 pollices ad 2½ pollices longa, ¾ pollicem lata, petiolo crassiusculo, ⅛ pollicem longo. Paniculæ breves, ½ pollicem longæ, in axillis foliorum summorum, pedunculis crassiusculis. Flores parvi, albi, ⅛ pollicem lati. Sepala 4, obovata oblonga, apicibus rotundatis recurvis, venis medianis elevatis. Petala nulla. Stamina copiosa, filamentis gracilibus flexuosis. Antheris ellipticis. Ovarium ovoideum. Stylus crassiusculus, staminibus brevior, flexuosus. Stigma minimum, peltatum. Drupa ¼ pollicem longa, elliptica, aurantiaca, pulpa parca. Semen oblongum ellipticum, vix ¼ pollicem longum.

An abundant and pretty little bush on the rocky banks of the Tahan River; perhaps most nearly allied to *C. microphyllum*, T. Anders., a small erect tree, with different leaves and fruit, growing on Mount Ophir in Malacca.

MALVACEÆ.

ABUTILON INDICUM, Sweet.

Waste ground, Pulau Tawar, Kwala Berar.

A. HASTATUM, n. sp. Suffrutex parva, ad 3-pedalis, caulibus rigidulis virgatis, pubescentia brunnea tectis. Folia hastata acuminata, petiolata, 2 pollices longa, $\frac{3}{4}$ pollicem lata ad basin, superne glabra, subtus rufo-pubescentia (siccata pallide brunnea). Anthela terminalis et axillaris paniculata, ramis gracillimis, virgatis, patulis. Flores minimi, $\frac{1}{4}$ pollicem in diametro, albi. Sepala 5, ovata acuta, viridia, pubescentia, extus parce stellato-pilosa, intus hispida, $\frac{3}{16}$ pollicem longa. Petala tenuia, alba, quam sepala breviora, late rotundato-ovata obtusissima. Stamina circiter 17, tubo brevi. Antheris brevibus, curvis, crassis, aurantiacis. Carpella 5, breviter rostrata, $\frac{3}{8}$ pollicem longa, parce pubescentia, transversim haud septata. Semina bina in carpello pyriformia angulata, atro-brunnea, pubescentia.

Open country at Kwala Berar; only a few plants seen and those nearly out of flower. The very small flowers open at midday.

SIDA RHOMBIFOLIA, Linn., var. **RETUSA**.

Common and variable. Pekan, Pulau Tawar, Kwala Tembeling, &c. Often forming small compact bushes.

S. CARPINIFOLIA, Linn.

Pekan, Pulau Tawar, &c. Common in valleys; also at Kamposa in Kelantan.

S. CORDIFOLIA, Linn.

Pekan and elsewhere.

S. MYSORENSIS, Wight & Arn.

Temerloh. Certainly not a common plant.

URENA LOBATA, Linn.

Very common up both the Pahang and Tembeling Rivers; in open country, campongs, and waste places.

——, var. **SINUATA**.

With deeply cut five-lobed leaves and a dark bar round the edge; is not so common as the preceding, but occurs in similar places, and is more characteristic of the sea-shore.

HIBISCUS ABELMOSCHUS, Linn.

Pulau Tijau.

H. MACROPHYLLUS, Roxb.

I found this in the form of a rather tall but slender tree, with few branches. The flowers were yellow-orange, with a purple centre spot. Dr. King gives them as purple, possibly describing them from withered flowers. Woods, River Tahan.

H. TILIACEUS, Linn. "Waroo" or "Baroo."

Common on the sea-coast at Sungei Meang, Kwala Pahang, Cherating, Rumpin. I saw one big plant a long way up the River Pahang, at Kwala Berar, far away from the sea-coast.

Hibiscus floccosus, Mast.

A big tree with yellow-orange flowers and a deep red-brown staminal tube. Woods along the banks of the Tahan River, and at Pulau Chengei on the Pahang River.

Thespesia populnea, Correa.

Common on the sea-coast at Kwala Pahang and elsewhere.

Eriodendron anfractuosum, DC.

Common in villages up the Pahang and Tembeling Rivers. It is called "Kapok"; I have never seen it indisputably wild.

Durio zibethinus, Linn.

Commonly cultivated. Some of the trees in Pekan are of remarkably large size. I do not think it is wild here, although big trees often occur in the midst of thick jungle; these, I believe, are either the remains of cultivation or sprung from seeds dropped by the wild tribes, who get the fruit from the villages and carry it about.

D., sp.

A small fruit, with the seeds enclosed in bright pink arils, was once brought to me in Pekan, from a tree found near that place in the jungle.

Boschia Griffithii, Mast.

Common in the woods along the Tahan River. The beautiful little scarlet durians of this big tree were often picked up on the ground in the forests. The tree is commonly called "Durian daun."

Neesia glabra, Becc.

Fruit found fallen in Tahan forests.

Cœlostegia sumatrana, Becc.

Fallen fruits were seen in the Tahan woods. This tree is called "Punggai" by the Malays, and its bark is used for tanning.

STERCULIACEÆ.

Sterculia parvifolia, Roxb.

A big tree, conspicuous far off from its crimson fruits, at Khol, on the Tembeling River.

S. macrophylla, Vent.

Pulau Papan, Pahang River.

S. scaphigera, Wall.

A very lofty tree. Woods at Kota Glanggi.

The seeds of this plant are sold in the Singapore markets under the name of "Kembang Sámangko,"—literally, that which fills a cup. The testa when put in water produces a brown mucilage, rich in bassorin, which is eaten with sugar, and is supposed to have cooling properties. The seeds are sold at 8 for a cent.

The tree occurs in Singapore and also in Malacca; but it is difficult to procure specimens, on account of its great height.

HERITIERA LITTORALIS, Dryand.

Common in the mangroves and damp sandy ground near the sea-shore. Kwala Pahang, Sungei Meang, &c.

HELICTERES VISCIDA, Wall.

A large bush with white flowers. Kwala Tembeling, Temerloh, &c.

MELOCHIA CORCHORIFOLIA, Linn.

Common. Pekan, Rumpin River.

ABROMA AUGUSTA, Linn.

Kalambalai, near Pekan.

LEPTONYCHIA GLABRA, Turcz., var. MASTERSIANA.

A small tree with green flowers. Temerloh, Tanjong Antan.

TILIACEÆ.

GREWIA PANICULATA, Roxb.

A common bush in the low country. Pekan, Kwala Tembeling, &c.; Pulau Manis.

TRIUMFETTA PILOSA, Roth. "Champadang."

Not common. Pekan, Tanjong Gajah Mati on the Pahang River.

T. RHOMBOIDEA, Jacq.

A common weed in waste ground. All up the rivers Pahang and Tembeling.

CORCHORUS ACUTANGULUS, Lam.

Sandy spots. Kwala Semantan, Kwala Tembeling.

C. TRIDENS, Linn.

Sandbanks in the Tembeling River. Local.

PORPA REPENS, Blume.

Common where it occurs. Rumpin River, Kwala Pahang, Sungei Meang. A prostrate sandy-shore plant with elegantly cut leaves. It has not hitherto been recorded from the Malay Peninsula.

ELÆOCARPUS GRIFFITHII, Mast.

A small tree. Pramau, near Pekan. The bright blue berries are sweet and eatable.

E. ROBUSTUS, Roxb.

Near the Sultan's tombs at Kwala Pahang; Pulau Rumput.

A pretty tree with racemes of beautiful white flowers and bright red young leaves.

E. OBTUSUS, Blume.

Local. Mahang. A fair-sized tree.

LINEÆ.

SARCOTHECA PANICULATA, n. sp. Rami quadranguli, rigidi. Folia dissita alterna, oblonga acuminata, petiolata, 4–6 pollices longa, 2 pollices lata, omnino glabra, superne lucida, subtus pallidiora, venis elevatis reticulatis, acumine obtuso; petiolo $\frac{1}{2}$ pollicem longo. Paniculæ graciles, laterales, 3-pollicares vel minores, ramis brevibus paucis, minute pubescentes. Flores albi, pedicellis gracilibus, $\frac{1}{4}$ pollicem longis, æqualiter dissiti. Sepala 4, late rotundata, imbricata, marginibus ciliatis. Petala 5, tenuissima, fugacia, lorata, apicibus obtusis, triplo sepalis longiora. Stamina 8–9, petalis breviora, omnia antherifera, filamenta tenuissima, basi connata, urceolo minimo. Antheræ reniformes, breves, versatiles. Styli 3–5, breves, glabri. Stigmata subglobosa, obscure lobata. Fructus haud visus.

Kwala Tahan.

Hitherto but one species of this genus has been described, viz. *S. macrophylla*, Blume, Mus. Bot. Lugd. Bat. i. p. 241, a native of Sumatra and Borneo. This has been referred to the genus *Roucheria* by Planchon, from which it differs in its capsular fruit and panicled inflorescence. It is a little-known plant, but is evidently a close ally of the above-described species, which differs from it in its smaller leaves and panicles (which latter, in *S. macrophylla*, are from 1 to 1½ feet long), in its four rounded ciliate sepals, which in Blume's plant are ovate acute and five in number, and in its glabrous style, &c. The number of the parts, however, seems to vary; one flower, for instance, has three, another five styles. The stamens are eight or nine; I have not seen ten, as in *S. macrophylla*. The petals seem to break off very soon, and probably, as in *Roucheria Griffithii*, the flowers last but a short time. The cup formed by the connation of the bases of the stamens is very short, and looks more of the nature of a disc.

ERYTHROXYLON BURMANICUM, Griff.

Common on sandy places near the shore at Kwala Pahang. A fine bushy tree, with reddish bark and bright green leaves.

IXONANTHES OBOVATA, Jack.

Pekan (*Dr. Haviland*).

I. ICOSANDRA, Jack.

Tahan River. Small tree overhanging the river.

MALPIGHIACEÆ.

TRISTELLATEIA AUSTRALASICA, A. Rich.

Common in the mangrove-swamps near Kwala Pahang.

HIPTAGE MADABLOTA, Gaertn.

Pekan and elsewhere; along the river-banks.

GERANIACEÆ.

BIOPHYTUM SENSITIVUM, DC., var. CANDOLLEANA.

Banks near the Pahang River. Tanjong Antan.

Shrubby plant, stem branched at apex; flowers bright yellow. I could not find any trace of sensitiveness in this plant. It is called "Payong Ali" (Ali's umbrella).

Averrhoa Carambola, Linn., and A. Bilimbi, Linn.

Both occur as escapes from cultivation. Near Pekan, Kwala Tembeling.

Hydrocera triflora, Willd.

Kwala Berar, swamps.

This plant is put into a bath by the Malays for use after confinements.

Dipterocarpeæ.

Dipterocarpus cornutus, Dyer.

Pulau Tawar woods.

D. Griffithii, Miq.

Kota Glanggi.

D. crinitus, Dyer.

Tahan woods.

D. pulcherrimus, n. sp. Arbor magna, ramis pendulis, ad 40 pedes alta vel elatior, crassa, ligno duro, rubro. Rami exsiccati nigrescentes. Folia subcoriacea, lanceolata acuta vel acuminata, glabra, basi rotundata, nervorum 14 paribus et carina subtus prominentibus, 6 pollices longa, 3 pollices lata, petiolis validulis pollicaribus. Flores copiosi in paniculis axillaribus vix 6-pollicaribus, ferme sessiles, ramis paniculæ sericeis. Calyx tubo obconico, $\frac{3}{4}$ pollicem longo (in anthesin), dense sericeo, 5-costato. Sepala 5, duo lorata, subobtusa, ultra $\frac{1}{2}$ pollicem longa, tria brevissima, omnia sericea. Corolla magna, petala lorata, obtusa, grisea, extus pubescentia, intus glabra, ochroleuca roseo-tincta, odore suavissimo, 2 pollices longa, $\frac{1}{2}$ pollicem lata. Stamina copiosa; filamenta brevissima, tenuia; antheræ $\frac{1}{4}$ pollicem longæ, connectivo elongato acuto, glabræ. Ovarium sericeum ad stylum glabrum attenuatum. Fructus roseus, maturus glaber, $1\frac{1}{4}$ pollicem longus, $\frac{1}{2}$ pollicem crassus, obconicus, 5-alatus, alis haud multo elevatis, inter sepala ad basin fructus; sepala 3 brevia, obtusa, lorata, 2 magna, lorata, lanceolata obtusa, 4 pollices longa, pollicem lata, venis reticulatis, mediana nulla.

Abundant on the banks of the River Tahan, and also on the River Tembeling and upper part of the Pahang River, but less frequent. I found fruits, too, floating in the mouth of the Tringganu River.

This noble tree is called "Nerrum" by the natives. Its chief beauty consists in the bright pink fruits, which, being produced in very large quantities, make the whole tree appear of a rose-colour. The flowers, as is often the case in the Dipterocarpeæ, are deliciously scented, and load the air with their fragrance. The timber is hard and good, red-coloured internally.

I have to thank Dr. Burck for examining this plant for me, and informing me that it is quite unknown to him.

Shorea Meranti, Burck.

Pulau Tawar woods.

ISOPTERA BORNEENSIS, Blume.

Temerloh.

A big tree called "Larat Api" by the natives. It also grows on Maxwell's Hill in Perak.

ANCISTROCLADUS PENANGIANUS, Wall.

Thickets at Ayer Hitam, near Pekan.

RUTACEÆ.

EVODIA ROXBURGHIANA, Benth.

At Pekan.

PARAMIGNYA MONOPHYLLA, Wight & Arn.

Temerloh, where it is called "Empeenai."

ZANTHOXYLUM OVALIFOLIUM, Wight ?

At Temerloh.

ACRONYCHIA LAURIFOLIA, Blume.

A big shrub with white flowers. On the Rumpin River in shady spots.

GLYCOSMIS PENTAPHYLLA, Correa.

Pekan.

G. PUBERULA, Lindl.

Pulau Jellam, Pahang River. Flowers white.

G. SAPINDOIDES, Lindl.

Pulau Tawar woods.

Called "Cheri Morai." This species is the commonest in the Peninsula.

MICROMELUM PUBESCENS, Blume.

A fair-sized tree with orange fruit. Common. Pekan, Kwala Tembeling, Tanjong Antan.

M. HIRSUTUM, Oliv.

At Tanjong Gajah Mati and Pulau Rumput on the Pahang River. "Che Nama" of the Malays.

Citrus decumana, Linn., *Citrus aurantium* var. *nobilis*, and *Citrus Medica* var. *acida* are cultivated to a small extent.

LUVUNGA SCANDENS, Ham.

Pekan.

SIMARUBEÆ.

BRUCEA SUMATRANA, Roxb.

Common in open country at Pekan and elsewhere along the river-banks.

EURYCOMA LATIFOLIA, Jack.

Open woods at Pekan.

This is known as "Bidara Pahit" (Bitter Plum); the bark, which is very bitter, is used in medicine.

OCHNACEÆ.

GOMPHIA SUMATRANA, Jack.

Tree overhanging the river. At the upper camp, Tahan River.

G. HOOKERI, Planch.

A small bushy tree. Only met with in fruit. The disc and calyx red; fruits black. Common on the sandy country at Pramau, opposite Pekan.

EUTHEMIS LEUCOCARPA, Jack.

Woods at Pramau.

The berries of this plant are by no means always white; they are often red or rose-colour. It varies also considerably in height and general appearance. It is very abundant in Singapore, frequenting especially sandy woods near the sea.

What I take to be *E. minor*, Jack, is a much rarer plant; I have only met with it in the islands south of Singapore.

BURSERACEÆ.

SANTIRIA LÆVIGATA, Blume.

A tree with pink flowers. At Kalambalai, near Pekan.

MELIACEÆ.

CHISOCHETON DIVERGENS, Blume.

Tree. Pekan.

AGLAIA DIEPENHORSTII, Miq.

The description of C. DC., in DC. Monogr. Phan. i. 603, fits this plant, which I found on the banks of the Tahan River.

LANSIUM DOMESTICUM, Jack.

The "Duku." Cultivated and half wild.

DYSOXYLUM BREVIPES, Hiern.

A common plant, which I believe to be what is intended by this species. Pulau Manis.

D. ALLIACEUM, Blume, var. LAXIFLORA.

A small tree with pendulous branches and panicles, loose but short-branched, of creamy-white flowers, and pear-shaped cream-coloured capsules, which split on the tree and expose three to four large red seeds. Abundant on the Tahan River. Called "Dosono" by the natives.

ILICINEÆ.

ILEX CYMOSA, Blume.

Common. Usually in the form of a large bush, but often forming a tree 40 feet high, with very white bark. Pekan.

I. MACROPHYLLA, Hook.

Near Pekan.

OLACINEÆ.

OLAX SCANDENS.

An erect shrub with white flowers. Sea-shore. Kwala Pahang; Pulau Tiuman; Tringganu.

GOMPHANDRA AFFINIS, Mast.?

Pulau Tawar.

CELASTRINEÆ.

LOPHOPETALUM, sp.

A common bush on the sea-shores at Tringganu, and also at Kwala Pahang.

Flowers yellowish white, withering pink; petals fimbriate; disc obscurely lobed, flat. Allied to *L. pallidum*, M. Laws., but the leaves are thicker and the veins more obscure.

EUONYMUS JAVANICUS, Blume.

Small tree. Kwala Tembeling.

MICROTROPIS BIVALVIS, Wall.

Limestone rocks, Kota Glanggi. Small tree with white flowers.

RHAMNEÆ.

VENTILAGO LEIOCARPA, Benth. "Kamagan Antan."

A common plant climbing high upon the trees in dense jungle, Temerloh, Tanjong Antan. The fallen fruits were also often picked up in other localities, as at Pulau Tawar and along the Tahan River.

V. MAINGAYII, M. Laws.

The description of this plant in the 'Flora of British India' is too incomplete to be able to identify the plant intended, but such description as there is fits a large climbing shrub found at Kwala Tembeling. It had stout stems conspicuously ribbed when dry, and oblong glabrous leaves drying black. The flowers exactly resembled those of *V. maderaspatana*, as figured in Wight's 'Icones,' but the spikes are very much more numerous and longer. The rhachis of the spike is pubescent. It is possibly merely a form of *V. maderaspatana*.

COLUBRINA ASIATICA, Brongn.

A common sea-shore bush, with dark green leaves and yellowish-green flowers.

Pulau Tiuman; Sungei Meang.

ZIZYPHUS ŒNOPLIA, Linn.

A neat bush on the banks of the river at Kwala Tembeling.

AMPELIDEÆ.

CISSUS MOLLISSIMA, Wall.

Pekan. Flowers white.

C. HASTATA, Miq.

Common. Pekan

CISSUS REPENS, Lam.

Pulau Tiuman.

C. HOOKERI. *Vitis Hookeri*, M. Laws.

Pekan.

This common plant is remarkable for its very ornamental, large, pale pink grapes, which look very tempting, but have the peculiarly irritating effect on the mouth, common to most of the wild grapes, very strongly developed.

C. FURCATA. *Vitis furcata* (M. Laws. ?).

Kwala Tembeling.

A fairly common vine, which I take to be the plant intended by Lawson.

TETRASTIGMA LANCEOLARIA, Planch.

On the islands up the Pahang River, and at Pulau Tawar; always near the river.

The curious ribbon-like stems and the compact tufts of flowers and fruits give this plant a curious appearance. The berries are quite small, round, and white, no bigger than peas.

PTERISANTHES GLABRA, n. sp. Scandens, glabra. Caules gracillimi. Folia trifoliolata, petiolis gracilibus, canaliculatis, pollicaribus, petiolulis ferme semipollicaribus, foliola tripollicaria vel paullo ultra pollicem lata, tenuia, lanceolata acuminata, basi angustata, venarum paribus tribus, in dentes marginales terminatis; foliola lateralia quam terminalia minora, obliqua (dimidio interiore quam exterius angustiore). Receptacula tenuia, plana, haud lobata, pedunculis gracilibus 3–4-pollicaribus, hippocrepica, 3–4 pollices longa, pollicem lata. Flores masculi in pedicellis longibus ultra pollicem, gracilibus, minuti, globosi. Feminei immersi, dissiti, perianthiis parvis cupuliformibus; ovaria rotundata, obscure 4–5-lobata. Baccæ non visæ.

Only once found in dense jungle far up the River Tahan.

The glabrous foliage, simple receptacle curved into a semicircle, and remarkably long pedicels of the male flowers distinguish this plant from any other.

P. RUFULA, Planch.

Pekan woods.

Planchon's description, in DC. Monogr. Phan. vol. v. p. 419 (Ampelideæ), is rather meagre, but I believe this is the plant he intended. It is not rare in the Peninsula. I have it from Chan-chu-kang in Singapore and from Malacca. The young leaves are lanceolate, with a very little red wool on the back, and the adult leaves are quite glabrous. The petiole joins the blade within its circumference, so that the leaf is subpeltate.

P. POLITA, Miq., var. LANCEOLATA. Folia lanceolata, superne glabra et polita.

Pekan (*Dr. Haviland*).

I have this also from one or two other localities in the Peninsula. The form of the leaves is quite different from that of the common variety; the inflorescence seems quite similar, however, and I do not think it is specifically distinct.

There are seven species of *Pterisanthes* known to me from the Peninsula, of which *Pt. polita* alone has simple leaves, the rest having 3–5-foliolate leaves *.

LEEA RUBRA, Blume.

Local. Pulau Chengei, Pulau Manis, Pahang River, in thickets.

A small plant, well-marked by its beautiful red inflorescence.

L. GIGANTEA, Griff.

Tahan woods. A striking plant with very large oval leaflets, 9 inches long and 4 across.

L. SAMBUCINA, Willd.

Pekan; Kwala Tembeling.

This is the common species in Singapore, where it often forms a small tree with a single stem. It has green petals and a white staminal tube, the lobes of which are blunt and notched. A plant collected in Perak by Wray, and named *L. gigantea* at Kew, closely resembles this plant in every respect, except that the lobes of the staminal tube are entire, but they are not acute as in the Tahan-woods plant. There is almost always a little rusty pubescence on the corymb branches. The fruit is brownish and rather dry, and the seeds have a low keel running along the back.

L. HORRIDA, Teysm.

Pulau Jellam, Pahang River, The "Malli-Malli" or "Mamalli" of the Malays, who believe that it has the property of keeping away tigers. A thorny bush with greenish-white flowers.

L. ÆQUATA, Linn.

Pulau Tiuman; Tahan River.

L., sp.

Kwala Tembeling; Pulau Chengei.

I cannot identify this; it is a low, thornless, bushy plant, with bipinnate leaves and narrow oblong acuminate leaflets, with one notch to each primary vein. The inflorescence resembles that of *L. horrida*, Teysm.

SAPINDACEÆ.

CARDIOSPERMUM HALICACABUM, Linn.

Common in campongs and open grounds. Pekan, Kwala Berar, &c.

ERIOGLOSSUM EDULE, Blume.

Small tree. Pekan, Renchong.

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* (1) *Pt. polita*, Miq., the commonest species, occurs in Chan-chu-kang in Singapore, at Petaling in Selangor, and at Maxwell's Hill, Perak; its variety, *lanceolata*, at Pahang, Singapore. (2) *Pt. Miquelii*, Planch. (syn. *Pt. arenosa*, Miq.), Western Hill, Perak, Penang. (3) *Pt. caudigera*, Planch., Malacca; called "Akar Gamat." (4) *Pt. pedata*, M. Laws., Selangor; called "Akar Kachang Gurunang" or "Burunang." (5) *Pt. heterantha*, M. Laws., Selangor, in Malacca; "Akar Sŭlŭnkak." (6) *Pt. rufula*, Planch., Malacca, Chan-chu-kang in Singapore, and Pekan in Pahang. (7) *Pt. glabra* (vide *suprà*, p. 287).

The species of *Pterisanthes* are all natives of the denser parts of the jungles, where they scramble through the lower bushes, and are very inconspicuous unless in fruit, when the red, tongue-shaped rhachis, with its round black grapes, is very striking.

ALLOPHYLLUS COBBE, Linn.

Common. Pekan, Kwala Pahang, Pulau Manis, Pulau Chengei, &c.; also Kelantan.

CUPANIA PLEUROPTERIS, Blume.

Small tree. Pekan.

C. ADENOPHYLLA, Planch.

Pulau Chengei, Pahang River.

C. PALLIDULA, Hiern.

Pekan.

C. LESSERTIANA, Camb.

Pekan.

XEROSPERMUM NORONHIANUM, Blume, var. "Balong Ayam."

Fairly large tree. Fruit yellow, ovoid-globose, nearly smooth. Tahan River, near Kwala Tenok.

The fruit is good eating. This plant differed from the ordinary form of the species, known usually as "Rambutan Pachat," in having the fruits not muricate, but rather dotted, like those of the "Mata Kuching" (*Nephelium malaiense*, Griff.). It was greedily devoured by the coolies. Hiern (Fl. Brit. Ind.) gives the fruit 1–2-lobed. I have never seen it otherwise than simple.

The typical form of this plant also was met with in the Tahan woods.

NEPHELIUM LAPPACEUM, Linn. "Rambutan."

Occurred half wild, and possibly also really wild, in the Tahan district, big trees occurring in the jungle in many places. The fruit is, however, carried about from the villages on the Tembeling River, where it is cultivated by the aborigines, and germinating seeds were often found in their encampments. Several forms were met with: one poor form with small sour red fruits occurred in the jungles at Kota Glanggi; another form in the Tahan woods had large yellow fruits with very long processes.

N. MUTABILE, Blume. "Pulessan."

Occurred as an escape in some of the woods on the Pahang River.

POMETIA TOMENTOSA, Kurz.

This fine tree occurred plentifully in the woods overhanging the Tahan River, and also lower down in the Tembeling and Pahang Rivers.

DODONEA VISCOSA, Linn.

Sea-shores at Kwala Pahang.

The sticky substance from which this plant takes its name only appears when the specimen is dry. A regular sea-shore plant. I have found it also at Lumut in the Dindings.

ANACARDIACEÆ.

ANACARDIUM OCCIDENTALE, Linn.

The Cashew-nut is common in sandy places along the river about Pekan.

BOUEA MICROPHYLLA, Griff.; and B. MACROPHYLLA, Griff.

Open country near Pekan, and often cultivated.

PARISHIA MAINGAYII, Hook.

Fruits fallen on the ground from a lofty tree at Pengkalan Balai.

GLUTA BENGHAS, Linn. "Rengas." A name also applied to almost any Anacardiaceous plant with black poisonous juice.

River-bank at Pekan, and near Kwala Tahan.

Fine large spreading trees with dark green foliage, white flowers, and light brown fruit full of the poisonous black juice.

I also found fruits floating in the sea at Tringganu, which germinated immediately on being planted.

BUCHANANIA LUCIDA, Blume.

Kwala Pahang.

B. ACUMINATA, Turcz.

Kadondong, Pulau Tawar.

CAMPNOSPERMA AURICULATA, Hook. f.

Big tree at Mahang.

C. GRIFFITHII, March.

Tahan woods.

SOLENOCARPUS VELUTINUS, Wight.

Very lofty trees in dense jungle along the Tembeling and Tahan Rivers.

MELANORRHŒA, sp.

A lofty tree of some species of this genus, covered with its beautiful pink fruit, was seen close to the river near Telor Malaki, but only a few young fruits could be picked up from the ground.

CONNARACEÆ.

AGELÆA WALLICHII, Hook. f.

Tahan woods.

This plant is common in the Peninsula. As in *A. vestita*, Hook. f., the fruits are velvety and of a beautiful crimson-scarlet colour.

ROUREA, sp.

A fairly large climber, with nearly sessile lanceolate-acuminate leaves, glabrous and shining above, much reticulated beneath, with a pubescent midrib. Fruit like that of *Rourea acuminata*, Hook. f., with which this plant is closely allied.

I cannot identify it with any species in the 'Flora of British India.'

Kwala Tembeling.

CNESTIS RAMIFLORA, Griff.

Common. Flowers pink and white. Kwala Tembeling, Tanjong Antan, Temerloh.

CONNARUS GIBBOSUS, Wall.

A half-scandent bush. Flowers lilac, buds bright sienna-brown. Capsules bright red. Common at Pramau, opposite Pekan.

This is one of the commonest species in the Peninsula, and is very variable in the form of its leaf and the extent to which it climbs.

Connarus semidecandrus, Jack?

A plant much resembling *C. gibbosus*, Wall., but differing in the inflorescence and leaves being covered with a scanty brown mealy pubescence. The panicles are larger and flowers bigger. The leaves of this plant were six-nerved, not five-nerved, as in the description of this species in the 'Flora of British India,' ii. p. 52. River Tahan.

Leguminosæ.

Crotalaria verrucosa, Linn.

A coarse soft herb looking like a *Salvia*, with light blue flowers. Local, but plentiful in some spots in open grassy country at Pulau Chengei and Tanjong Antan, Pulau Tawar.

C. retusa, Linn.

Open ground. Pulau Tawar.

C. ferruginea, R. Grah.?

Katapong, Pekan.

C. sessiliflora, Linn.

Tanjong Antan, Pulau Tawar. Open grassy country. Flowers light blue.

C. striata, Linn.

Kelantan River banks.

Indigofera tinctoria, Linn.

Occurs sporadically in Pahang from the mouth of the river as far as Pekan, and is now very abundant in waste ground in the town.

I. hirsuta, Linn.

Local. Kwala Pahang and near the Sultan's tombs; in open country.

Millettia atropurpurea, Benth.

A noble tree covered with its deep purple flowers. The native name is "Chickak."

Temerloh, Guai.

M., sp.

A tree with pendulous branches and flat, thin, green pods.

Tembeling and Tahan Rivers. Flowers not seen. A common plant here; I have it also in fruit from the Plus River, Perak, collected by Mr. Wray.

M., sp.

A small tree with very beautiful deep brown velvety pods, which look black at a little distance. Flowers not seen.

Common along the Tahan River.

Tephrosia purpurea, Pers.

Kwala Brawas, near Kwala Pahang. Open sandy places.

URARIA CRINITA, Desv.

This charming lupine-like plant, though widely scattered over the open country on the river-bank, is rather local. The flowers are light violet-blue (not purplish, as described in the 'Flora of British India').

Pekan; Renchong, on the Pahang River.

U. LAGOPODIOIDES, DC.

A smaller plant; not trailing, but rather decumbent or suberect; the leaflets ovate-elliptic. Flowers white, blue, or pink.

Open grassy country round Pulau Tawar, Pulau Manis, Kwala Tembeling.

DESMODIUM UMBELLATUM, DC.

A common sea-shore shrub, occurring on all the sea-coasts. Flowers white.

Rumpin; Kwala Pahang.

D. PULCHELLUM, Benth.

A small shrub, with the branches covered with curious orbicular bracts.

Tanjong Antan, Pulau Manis, in open country.

D. RETROFLEXUM, DC.

Pekan, Kwala Tembeling; open country.

D. POLYCARPUM, DC.

Common in open sandy country, especially near the sea. Flowers purple.

Pekan, Katapong.

——, var. **ALBUM**.

Flowers white.

Under the Casuarinas on the sea-shore at Kwala Pahang, Kwala Brawas, and Sungei Meang.

D. HETEROPHYLLUM, DC.

Katapong, Pekan, &c. Common.

D. TRIFLORUM, DC.

Pekan &c. Common.

ABRUS PRECATORIUS, Linn.

Sea-shores, Kwala Pahang. Common.

MUCUNA MONOSPERMA, DC.

Climber; flowers violet-purple.

Kwala Tembeling.

It is called "Kachang Babi" (Pig's bean) by the natives.

M. ACUMINATA, R. Grah., in Wallich's Catalogue, no. 5621.

This plant appears never to have been described. It was obtained in Penang. Mr. Baker (Fl. Brit. Ind. ii. p. 185) writes of it:—"The calyx is like that of *M. imbricata*, but the corolla is smaller and the racemes are short-peduncled and corymbose, like those of *M. monosperma*, but the fruit is unknown." A plant collected in thick swampy jungle between Pekan and Kwala Pahang may be, says Dr. King, this species. (I have since collected it again at Tanjong Kling, near Malacca.) I give a description of it:—

A slender climber. Leaflets glabrous, ovate-lanceolate, acuminate, rather thin, six-veined, 3 inches long by 1½ broad; laterals very oblique, *i.e.* one side much narrower than the other. Flowers few, two or three in a short raceme, fairly large, of a pale sea-green, 1 inch long, drying black. Calyx campanulate, large, finely pubescent. Corolla standard green; wings oblong, obtuse, falcate, 1¼ inch long; keel white, falcate, shorter than the wings. Stamens pubescent at base. Pod stalked, oblong, 4 inches long, 1½ broad, two- to three-seeded, indented between the seeds, with two low keels running along the sutures; no transverse oblique side ridges; entirely covered with fox-coloured irritating hairs.

In the small raceme of curious green flowers and the form of the pod this is peculiar. It does not belong to the section *Amphiptera*, as suggested by Mr. Baker, for that has broad wings along the sutures and oblique plaits, but is more nearly allied to *M. gigantea*, DC., which has wings on the suture and no plaits, and which also, unlike most of the species, has yellow and not dark violet flowers.

Erythrina indica, Lam.?

Is planted commonly in the villages as a pepper support. It is constantly pollarded, so that flowers cannot be obtained. Some evidently very old trees occur at Pulau Tawar.

Canavalia ensiformis, DC.

Common in jungle and thickets along the river-banks.

C. obtusifolia, DC.

Common along the sea-shore here, as all over the Peninsula. Kwala Pahang, Cherating. The seeds of this bean are quite eatable, though rather mealy.

Vigna lutea, A. Gray.

Sea-shores, Kwala Pahan. Common all along the Peninsula.

V. luteola, Benth.

Kwala Tembeling, Pekan.

Clitoria ternatea, Linn.

Is often cultivated in and near Pekang.

(C. cajanæfolia, Benth., which is so common in Singapore, does not occur in Pahang, nor have I ever seen it in country that has not been at some time under cultivation. I suspect it is not really a native of the Peninsula.)

Rhynchosia aurea, DC.

Small creeping vetch, with bright yellow flowers.
Common at Kwala Pahang and near Pekan.

Flemingia strobilifera, R. Br.

Villages and open country. Pekan, Kwala Berar.

Flemingia congesta, Roxb.

Common in open country. Pekan, Blay Manis, and at one spot on the river-bank of the Tahan River near Kwala Tenok.

Dalbergia foliacea, Wall.

Near Jambo, opposite Pekan. Only recorded hitherto from Burmah.

D. ferruginea, Benth.?

Tahan River, near Kwala Tenok.

Exactly similar to a plant collected in Kedah by Mr. Curtis, No. 2625.

Pterocarpus indicus, Willd.

There are some very large trees of this well-known plant, the "Angsana," in Pekan, and also at the Sultan's tombs near Kwala Pahang.

Derris uliginosa, Benth.

Kwala Pahang.

D. amœna, Benth.?

A beautiful climber, clothing the trees between Kwala Pahang and Pekan; answering to the description of this plant in the 'Flora of British India,' except that the flowers are there described as "bright red," but in this plant were snow-white. Fruit was not obtained.

D. thyrsiflora, Benth.

Bohie, Pekan; Kwala Tembeling; Kalambalai, near Pekan. Not rare. Called by the natives "Tambong Neoh."

This plant is very common in Singapore. It never seems to climb to any height, but is most often met with as a long-armed straggling bush. The flowers, which are rather fugacious, are pure white, and are produced in immense quantity when the plant does bloom, which does not happen every year. They are much frequented by small blue butterflies. The fruits become eventually bright red.

Dialium, sp.

The sweet pods of some species of this genus were found on the ground several times in the high woods of the Tahan River near Kwala Tenok.

D. laurinum, Baker.

At Pigang, near Pekan.

Saraca cauliflora, Baker.

Common in the woods at Kwala Tembeling and Kota Glanggi.

A tall slender tree, with great tufts of orange-yellow flowers springing from the old wood, succeeded by very large pink pods.

It is also common in the rocky woods round the limestone caves of Kwala Lumpur in Selangor.

AFZELIA PALEMBANICA, Baker?

Big trees of "Merabau," in fruit, were seen in several places along the Pahang River, probably belonging to this species.

BAUHINIA INTEGRIFOLIA, Roxb.

This beautiful climber is very common up all the rivers, and forms a conspicuous object in the scenery, with its masses of red flowers turning orange.

There is a curious plant, often met with in these jungles, which has very broad, almost triangular leaves, 3 inches long by 6 inches across, the upper margin very deeply excavate and the points much divaricate. It is evidently a *Bauhinia* in a young state, and I found it eventually developing into what appeared to be this species. This form, known to the natives of Kemaman as "Akar Dow," I have met with in many places in the Peninsula, but never where (as in Singapore) *B. integrifolia* is absent.

B. (§ PHANERA) SUFFRUTICOSA, n. sp. Frutex magna, cirrhosa, scandens, ramis ligneis, cortice griseo-brunneo, lenticellis copiosis. Folia coriacea, undique glabra, cordato-rotundata vel ovata obtusissima, fissa ferme ad dimidium, 3½ pollices longa, 4 pollices lata, superne subnitida, subtus pallide brunnea (ex sicca), nervis 4 utroque latere elevatis; petiolus ultra pollicem longus. Stipulæ magnæ, papyraceæ, obovatæ, apicibus rotundatis (exsiccatæ pallide brunneæ), majusculæ circiter pollicem longæ. Flores, in racemo brevi, breviter pedicellati, bibracteati, pedicellis puberulis. Sepala crassa, subcarnosa, albo-sericea. Petala sericea, oblanceolata (alba visa in alabastro). Stamina tria, glabra, antheræ superne acuminatæ. Stylus crassus. Stigma haud obliquum, magnum, rotundatum. Ovarium sericeo-pubescens, canaliculatum. Legumen oblongum, 4½ pollices longum, 2 pollices latum, ligneum, mox dehiscens, nitidum, atro-brunneum, stylo elongato in dehiscentia fisso terminato, marginibus leguminis haud elevatis, haud incrassatis. Semina plana, brunnea, 2–3, circiter pollicem longa.

At Kwala Tembeling, in thickets on the river-bank. I was unable to get open flowers; the buds were far advanced when we were on the return journey, but I saw none open, and have never seen the plant elsewhere. It is an ally of *B. ferruginea*, Roxb., but in foliage and habit quite distinct.

ORMOSIA, sp.

Katapong, near Pekan.

I have never met with flowers of this fine tree, which occurs in several places in Singapore. It has a compact head of deep green leaves, and the pod is woody and distinctly beaked, containing one or, rarely, two somewhat flattened scarlet seeds. I should take it to be *O. microsperma*, Baker, but that is described as having a subcompressed red orbicular pod with thin valves, and the seeds ¼ inch long and turgid, whereas this species has a rather flattened seed nearly ½ inch broad.

CÆSALPINIA BONDUCELLA, Flem.

Fairly common on the sea-coast, Kwala Pahang.

CÆSALPINIA NUGA, Ait.

Jambo, opposite Pekan.

C. SAPPAN, Linn.

Common in villages all up the Rivers Pahang and Tembeling. Also (indisputably wild) in dense jungle overhanging the River Tahan.

CASSIA JAVANICA, Linn.

A big tree, its branches clothed with beautiful rose-coloured flowers.

Renchong, Pahang River.

C. TIMORENSIS, DC.

Here and there on the banks of the Pahang River above Pekan.

C. TORA, Linn.

A common weed in waste ground round Pekan, Pulau Manis, &c.; also on islands in Tembling River.

C. ALATA, Linn.

Common in damp spots in open country all up the Rivers Pahang and Tembeling. Its value as a drug in cases of skin-disease is well known to the Malays.

CYNOMETRA RAMIFLORA, Linn.

Small tree, met with once or twice in fruit in the Tahan woods.

SINDORA WALLICHII, Benth.

Pods of this tree were picked up on the ground in the forests.

Baker describes the calyx as armed with large firm prickles. This is not quite correct, as the so-called prickles are really quite soft processes when the plant is alive. It is a very lofty and inaccessible tree. When in flower it is visited by enormous numbers of bees and flies, the roar of whose wings can be heard from the foot of the tree.

ENTADA SCANDENS, Benth.

Pekan and on the islands up the Pahang River at Kwala Luit and Pulau Kuichi. Common.

This plant has a habit of flowering after the fall of the leaves and before the new ones come out. There is at least one, and perhaps two, other species of this genus native in Singapore; but the above is the only one I have met with in Pahang, and is the only one recorded for the whole Indian region.

PARKIA ROXBURGHII, G. Don.

Abundant in the woods along the river-banks in Pahang, and often planted in villages in Temerloh &c.

This is the "Petay," the beans of which are so greedily sought by the Malays and eaten with curries; but it causes their bodies to exhale so fœtid an odour that it is impossible to have them in camp.

MIMOSA PUDICA, Linn.

The Sensitive Plant has already established itself in Pekan.

ACACIA FARNESIANA, Willd.

Common in and round Pekan, and occurring also further up the river in villages. I see no reason to imagine it native.

A. CONCINNA, DC.

A common shrub along the banks of the Rivers Tembeling, Pahang, and Tahan, at Passir Loyang, Pulau Tawar, and Kwala Tembeling, in dense thickets.

A very prickly plant with whitish-yellow flower-heads.

A. PENNATA, Willd.

At Tulomalata, Pahang River, called "Akar Kayu Manis."

PITHECOLOBIUM FASCICULATUM, Benth.

Pulau Chengei.

A large tree, not rare in many parts of the Peninsula.

P. CLYPEARIA, Benth.

A common small tree, Pekan.

P. LOBATUM, Benth.

Cultivated and wild all over the more open country in Pahang, and up the River Tahan for at least a mile. This is the "Jering" (whence Jack invented the generic name of *Jiringa*). It is eagerly sought by Malays, who eat the seeds, which produce the same objectionable results as *Parkia*-pods.

ROSACEÆ.

PARINARIUM GRIFFITHIANUM, Benth.

A fine large tree with bright green leaves and white flowers.

On the river-bank at Mahang.

P. ASPERULUM, Miq.

A small tree, apparently belonging to this species, was found in the Tahan woods, but the flowers are too young to be sure of.

P. NITIDUM, Hook. f.

A tree of moderate size. Kwala Pahang.

RUBUS MOLUCCANUS, Linn.

Very abundant at Kwala Tembeling and Temerloh; also seen on the Tahan River. It is called "Tampah Ragat."

The flowers are white, and the fruit orange-red, very sweet, and eatable.

CRASSULACEÆ.

BRYOPHYLLUM CALYCINUM, Salisb.

Common at Kwala Pahang and in the environs of Pekan.

DROSERACEÆ.

DROSERA BURMANNI, Vahl.

Plentiful in the sandy districts at Pramau, opposite Pekan, and towards Kwala Pahang. Leaves red, flowers white.

MYRTACEÆ.

RHODAMNIA TRINERVIA, Blume.

Common in Pakan in the low country, but getting scarcer higher up, occurring as far up as Temerloh.

RHODOMYRTUS TOMENTOSA, Wight.

An abundant bush in the sandy country at Kwala Pahang and Pekan.

The berries are the best wild fruit here.

EUGENIA GRANDIS, Wight.

Open country in Kwala Pahang and round Pekan; also Tringanu and Pulau Tiuman, disappearing inland.

A big tree with white flowers and green globose fruit, which have a small amount of sweetish pulp and are greedily devoured by wild animals. As its native name ("Jambu Ayer-Laut," *i. e.* Sea Rose-apple) implies, it is typically a sea-shore plant, and as such is very common on the coast of Singapore and other parts of the Malay Peninsula.

E. INOPHYLLA, Roxb.

Pekan.

E. ZEYLANICA, Wight.

Common at Praman and elsewhere in the open country near Pekan. The common Malay name is "Nasi-Nasi" (Rice), from its white berries vaguely suggesting rice.

The fruits are aromatic and sweet, but rather dry. It is usually a bush, more rarely a small tree.

E. LINEATA, Blume.

I saw a number of trees of what appear to belong to this species, though not in flower, in the woods, at Tanjong Medang near Pekan. It is very common in Singapore, especially near the sea.

E. MAINGAYII, Duthie.

A fairly large tree or shrub with copious flowers, with pale orange calyces and fruit, on heaths near Kwala Pahang. I think this beautiful tree is the one intended by Duthie under the above name; the flowers are smaller than those of *E. leptantha*, Wight, a native of Penang, and the bases of the leaves are decidedly rounded.

Eugenia Heyneana, Wall.

A small tree, with willow-like leaves and globose white fruits, hanging over the river at Tahan.

E. aff. verecunda, Wall.

Bushy plant with white flowers. Katapong near Pekan. Also collected by Curtis in Penang.

E. cauliflora, n. sp. Arbor elata, gracilis, cortice brunneo. Folia elongata, lanceolata acuminata, subacuta, sessilia, opposita aut alterna, coriacea, haud lucida, subtus glauca, basi rotundata subbiloba, 18 pollices longa, 2 pollices lata, carina prominula, nec acuta, ad basin folii abrupte incrassata et transversim rugosa, nervis intramarginalibus margine approximatis, transversis vix ascendentibus, ultra triginta in utroque latere. Paniculæ paucæ, 2 pollices longæ, e ligno vetusto exortæ, ramis paucis, octo-floræ. Flores pollicem longi, pedicellis $\frac{1}{4}$ pollicem longis, omnino kermesini, speciosi. Sepala 4, ovata, punctata, marginibus pallidis, persistentia, 2 externa parva, ovata acuta, interiora majora, obtusa. Petala 4, inæqualia, tenuia, marginibus albescentibus, ovatis rotundatis. Stamina copiosa, filamentis gracilibus, antheris parvis, oblongis. Stylus gracilis, ferme $\frac{3}{4}$ pollicem longus, superne attenuatus. Stigma minutum. Ovarium obconicum.

Dense jungle in the Tahan woods, very rare. I only saw two trees of this beautiful *Eugenia*, with one cluster of flowers on each. The growth of the flowers on the old wood is, I believe, quite peculiar.

E. (§ Jambosa) tiumanensis, n. sp. Arbor magna, ramis gracilibus patulis, circiter 20-pedalis. Folia tenuia, opposita, exacte lanceolata aut lanceolata acuminata, læte virentia (sicca cinereo-viridia), 4 pollices longa, pollicem lata, nervis intramarginalibus, margine remotis, carina elevata; petioli pollicares, graciles. Flores sessiles, in capitulo brevi terminali, mediocres, albi. Bracteæ minutæ, setaceæ. Calyx campanulatus, lobi magni, rotundati, $\frac{1}{2}$ pollicem longi. Stamina alba, $\frac{1}{2}$ pollicem longa, copiosa. Petala brevia, oblonga, rotundata, alba. Stylus elongatus, gracilis, rectus (in alabastro uncinatus).

Pulau Tiuman. I only saw one tree with very few flowers in a dense rocky jungle.

There are a number of other Eugenias in this region of which I have specimens, but owing to the difficulty of defining the species of the genus I am unable to identify them.

Barringtonia racemosa, Blume.

In tidal swamps at Ayer Hitam, near Pekan, and again in the Tahan River.

This plant does not confine itself to sea-coasts or rather to tidal rivers, which it most affects, but occurs a long way up the freshwater streams, though more rarely. It is called "Putat-Gajah" in Pahang—"Putat" being the generic Malay name for *Barringtonia*; "Gajah" signifies large (literally Elephant).

B., sp.

A big tree, with thin-textured petiolate leaves and erect spikes of white and pink flowers, occurred at Kwala Tembeling.

Barringtonia acutangula, Gaertn.

This is a small straggling bush, here only a few feet in height, growing on the river-bank from Pekan upwards. In India it is described as a tree 30 to 40 feet high.

B. macrostachya, Kurz.

Occurred at Kwala Tembeling.

It is common in sandy woods in Singapore, often far away from water. It forms a large shrub or small straggling tree, with either white or pink flowers, rather larger than in most species.

RHIZOPHOREÆ.

Kandelia Rheedii, Wight & Arn.

Rumpin River.

Rhizophora conjugata, Linn.

Sungei Meang.

Bruguiera caryophylloides, Blume.

Sungei Meang.

B. eriopetala, Wight & Arn.

Sungei Meang.

Gynotroches axillaris, Miq.

Pekan, Kwala Pahang. A very common tree.

COMBRETACEÆ.

Terminalia Catappa, Linn.

Sea-shores at Kwala Pahang, Sungei Meang.

This plant is certainly native along our shores, but does not seem to occur inland except where planted. It is one of those trees of which the seeds are constantly dispersed by sea-currents, and so is found on almost all small islands in this region.

Lumnitzera coccinea, Wight & Arn.

Sea-shores, Cherating.

Usually a small bushy tree, but often tall and straight. It is called "Terentam" in Singapore, and the wood is in some repute for axles of ox-carts and such work.

Combretum tetralophum, C. B. Clarke.

Flowers yellow. Katapong near Pekan.

C. ovalifolium, Roxb.

Flowers green. Pulau Chengei, Pahang River.

Quisqualis indica, Linn.

Apparently quite wild on the banks of the river at Pekan and Kwala Luit.

MELASTOMACEÆ.

Melastoma molle, Wall.

Banks of the Tahan.

A lovely shrub with very large pale rose flowers.

MELASTOMA POLYANTHUM, Blume.

Kwala Pahang.

——, var. ALBUM.

Pulau Rumput, Pahang River.

A pretty white-flowered form of this common species.

M. NITIDUM, Zoll. ?

A very narrow-leaved plant with pale foliage and smaller flowers, abundant in the rocky islets in the Tahan, may belong to this species.

The distribution of these *Melastomas* is rather curious. In Singapore, Johore, and Penang *M. polyanthum* is most abundant, and is known as the Singapore Rhododendron. In Penang, Kedah, and Perak it is replaced by *M. malabathricum*, Linn.

ALLOMORPHIA ROSEA, n. sp. Frutex parva, ramis obtusangulis, crassiusculis. Folia lanceolata acuminata acuta, carnosula, petiolata, 12 pollices longa, 4 pollices lata, petiolis validulis, 3 pollices longis, nervis tribus elevatis intramarginalibus, tenuioribus, nervulis transversis, subtus multo elevatis, parallelis. Panicula magna, pedunculo validulo, lepidoto, ramis ultra 6-pollicaribus. Flores $\frac{3}{8}$ pollicem longi, rosei. Sepala brevia, triangularia, obtusa. Petala 4, oblonga, brevia. Stamina 8, filamenta gracilia, pubescentia. Antheræ glabræ, lineares, oblongæ, apicibus obtusis, basi breviter bilobis. Stylus crassiusculus. Capsula rosea, $\frac{1}{4}$ pollicem longa, obconica, quadrangula, costis intermediis vix elevatis, basi ad pedicellum attenuata, superne infra sepala brevia et obtusa contracta.

Tahan woods.

A pretty plant, very distinct in the form and texture of the leaves and in the form of the fruit.

SONERILA OBLIQUA, Korth.

Woods of the Tahan River.

Flowers pink, the leaves when young spotted with white. This is the commonest species in the Peninsula.

S. MOLUCCANA, Roxb.

Growing with the last species.

S. IMPATIENS, Becc. ?

A very small and pretty little species, with leaves either green with white spots or entirely purple.

Tahan woods. Apparently identical with the Bornean plant.

PHYLLAGATHIS ROTUNDIFOLIA, Blume.

Very abundant in the Kota Glanggi and Tahan woods.

DISSOCHÆTA GRACILIS, Blume.

Woods at the mouth of the Tahan River.

MARUMIA NEMOROSA, Blume.

At Kwala Luit and Kwala Tahan.

This, like other scandant Melastomaceæ, is called "Akar Sendudu."

MEDINILLA RUBICUNDA, Blume?

On trees, Tahan woods.

M. HASSELTI, Blume.

Pramau woods, near Pekan.

PACHYCENTRIA GLAUCA, Triana.

Tahan woods.

This plant, common as it is in Singapore, has not been recorded previously from the Peninsula. It is one of Beccari's ant-plants (*Piante ospitatrici*); but though ants do make nests among the tubercles of the roots, I never saw them living inside the tubercles, which are always solid, and this is also true of the next species.

P. MACRORRHIZA, Becc.

Tahan woods. Also Singapore, but not common, and Penang.

MEMECYLON EDULE, Roxb., var.?

A lovely shrub, often loaded with its charming little blue flowers.

Pramau, open country.

M. HEPTAPLEURUM, Blume.

Tahan River, Kwala Tembeling, &c. "Nipis Kulit."

M. sp. aff. GRIFFITHIANUM, Naud.

Kwala Tahan, Tembeling, and also at Kwala Lumpin in Selayn.

A small slender tree, with pink petals and blue stamens, in dense woods.

PTERNANDRA CÆRULESCENS, Jack.

Pekan.

ONAGRACEÆ.

JUSSIÆA REPENS, Linn.

Common in swamps at Kwala Pahang.

J. SUFFRUTICOSA, Linn., var. ANGUSTIFOLIA.

At Kamposa in Kelantan.

A shrubby plant, with large buff-coloured flowers.

LUDWIGIA PARVIFLORA, Roxb.

Exceedingly common in waste places, sandbanks, &c. Pahang and Tembeling Rivers.

FICOIDEÆ.

MOLLUGO STRICTA, Linn.

A common weed in dry places. Pekan, Kwala Tembeling. On dry sandbanks the whole plant becomes red. Also Kamposa in Kelantan.

M. SPERGULA, Linn.

Open dry spots; less common. Pekan, near Kalambalai; also at Kamposa in Kelantan.

SESUVIUM PORTULACASTRUM, Linn.

Muddy spots on the sea-shore. Sungei Meang.

LYTHRACEÆ.

LAGERSTRŒMIA FLORIBUNDA, Jack.

Common up the River Pahang as far as Kwala Tembeling, forming a most conspicuous feature in the scenery.

L. HEXAPTERA, Miq.

A tree about 60 feet high; flowers pink. Kwala Tahan.

SONNERATIA ACIDA, Linn. f.

Mouth of the Pahang River.

This is not the commonest species in the Malayan Peninsula, *S. alba* being more abundant. This latter, described by Kurz as not exceeding 15 feet, here attains a very large size. It grows very abundantly round Singapore, often so far out from the mainland that at high tide the trees appear to be growing in the open sea. The fruits are eatable, but not good. The tree is known as "Prapat."

The flowers appear to open very late in the afternoon, in fact at sundown, when they are visited by numbers of bees (*Apis dorsalis*) and butterflies of the family *Hesperidæ*.

BEGONIACEÆ.

BEGONIA SINUATA, Wall.

Rocks on the Tahan River banks. This is a most variable plant, and includes a large number of forms.

B. FALLAX, A. DC. (*Diploclinium bombycinum*, Klotzsch.)

Rocky streams entering the Tahan River.

A small-flowered plant with deep green velvety leaves. This fits Wight's figure (Icones, t. 1817) fairly well; he gave it the name of *Diploclinium Lindleyanum*. Miquel gives *Begonia isoptera*, Dryand., as a synonym of *Diploclinum bombycinum*, Klotzsch, and thinks Wight's plant is merely a form of the same. *B. isoptera* is common in Borneo, where it is apparently very variable in size and form of leaves. The Pahang plant is more slender than any of the Bornean forms I have, and it is possible may be eventually specifically distinguished.

B. aff. ALBOCOCCINEA, Hook.?

Limestone rocks, Kota Glanggi caves.

A pretty little *Begonia*, resembling the figure in the 'Botanical Magazine,' t. 4172, but the flowers are very much smaller, and the plant has none of the red colouring about it.

There are two or three other species of this section of *Begonias* in the Peninsula which are apparently not included in the 'Flora of British India.'

A very fine plant, of which I found a single specimen on a rocky stream far up the River Tahan, was stemless, with leaves about two feet long, with a broadly ovate acute blade, the edges waved, glabrous except for the veins beneath, but little unequal. The scape is fleshy and winged, about a foot long, terminated by short dichotomous branches bearing a few rather large white flowers with red bracts. The male flowers have two large ovate petals and two much smaller and narrower ones. Stamens numerous, not appendaged. The female flowers I have not seen. The fruit (unripe) has one large and two small wings.

It is probable that this will prove a new species. I can find no description answering to it, but I am unwilling to describe it as new till I can procure ripe fruit and female flowers. The great rhubarb-like leaves are plain green, but it would be well worth cultivating for its flowers.

PASSIFLOREÆ.

MODECCA, sp.

A fairly common species occurs along the Tahan and Tembeling Rivers which I cannot identify with any described species. It resembles *M. singaporeana* (the commonest kind in the Malay Peninsula, though I did not find it in Pahang), except that the fruit is nearly globose, much shorter than any other kind that I know, and the leaves are broader and more oval. I have never seen the flowers. The difference in form of the fruit from that of *M. singaporeana* is very conspicuous. It is a very showy plant, covering the trees with its bright crimson fruits.

CUCURBITACEÆ.

HODGSONIA HETEROCLITA, Hook. f.

A big climber, with deep green leaves and large, globose, flattened, smooth, minutely pubescent woody gourds about six inches through. The pubescence on these gourds prevents their getting wet when they fall into the water; they are not rarely seen floating in the sea. They are grey-green, not at all red; seeds 5 or 6, very large, woody, grooved. Pulp of gourd firm and fleshy, very oily.

Tembeling, Pahang, and Tahan Rivers.

MOMORDICA COCHINCHINENSIS, Spreng.

Khol, Tembeling River, Tahan River.

Scrambling over bushes by the river-banks. Flowers large, cream-colour, with black spots in base, and black sepals. Pumpkin orange-scarlet, oblong, with numerous prickles.

MELOTHRIA, sp. "Timon Tikus."

Tanjong Gajah Mati; Pekan, Pahang River.

The little round gourds are quite eatable and taste like cucumbers.

CITRULLUS VULGARIS, Schrad.

Water-melon, cultivated at Pekan.

UMBELLIFERÆ.

HYDROCOTYLE ASIATICA, Linn.

The "Pegaga," used everywhere in curries and as medicine. A common weed in all cultivated spots.

ARALIACEÆ.

ARALIA THOMSONII, Seem.?

A big shrub, very softly pubescent all over. Leaves bipinnate, with very thorny petioles and rhachis about three feet long, pinnæ about 5; leaflets 11 on a pinnule, opposite, lanceolate or almost ovate lanceolate acuminate, distinctly or very obscurely serrate, woolly pubescent, with stiffer red hairs on the veins, 3–4 inches long or much less. Thorns on the rhachis and its subdivisions only, not on the midrib of the lamina, straight, acute. Panicles large, about 2 feet in length. Fruits with five ridges, about 12 in an umbel on pedicels half an inch long.

Near Pekan. I have this also from Gunong Brumban in Sungei Ujong, under the name of "Poko Dulang Dulang," and it is common in the Thaiping Hills. Seemann's plant came from the Khasiya Mountains. I have not been able to compare it with this species, and it is probably distinct.

ARALIDIUM PINNATIFIDUM, Miq.

A small tree with elegantly cut leaves and large oblong drupes, at first white, afterwards black, with a nasty soapy taste.

Kwala Tembeling; Pulau Chengei.

HEPTAPLEURUM SUBULATUM, Seem.

An epiphyte, rather common in woods at Pramau, Kota Glanggi, Passir Loyang, and on the Tahan River.

H. VENULOSUM, Seem.

A shrub, with fruits passing from yellow to red, and finally black.

Kwala Tembeling.

TREVESIA SUNDAICA, Miq.

Common in some spots.

Kwala Tembeling and Tahan River.

ARTHROPHYLLUM DIVERSIFOLIUM, Blume.

In open woods and secondary jungle; less common than in Singapore.

Pekan, Tanjong Antan.

GAMOPETALÆ.

RUBIACEÆ.

SARCOCEPHALUS SUBDITUS, Miq.

Pulau Chengei.

A straggling small tree, leaves glabrous. Fruits brown, with concave summits to the carpels. The heads of flowers are ternate. Called "Markel."

STEPHEGYNE DIVERSIFOLIA, Hook. f.?

Kwala Berar. Native name "Kutum."

It also occurs near Petaling by Kwala Lumpur, in Selangor. A handsome tree with yellow balls of flowers. I take it to belong to this species as the corolla-lobes are bearded inside; but it has a short five-toothed calyx-tube, while the Burmese plant is said to have no calyx-tube.

CEPHALANTHUS ARALIOIDES, Zoll.

Tahan River.

A pretty tree, with yellowish-white balls of flowers. Common along the river-bank. I have the same plant also from Borneo collected by Dr. Haviland.

UNCARIA PEDICELLATA, Roxb.

Tahan woods, Pulau Manis.

One of the biggest of the Gambirs, climbing high over the trees, and forming stout leaves.

U. FERREA, DC.

Pulau Chengei.

This is not a very common species in the Peninsula. The heads of flowers are sessile when in bud and woolly, but the peduncles lengthen out before the flowers open.

U. GAMBIR, Roxb.

Is cultivated, I am told, at Tembeling at a point above the mouth of the Tahan River, so that I did not see it. It is said to have been cultivated there for many generations. Chewing-gambir only is prepared there, and it is not exported.

COPTOSAPELTA FLAVESCENS, Korth.

A very sweet-scented climber, with large trusses of white flowers. Temerloh.

C. GRIFFITHII, Hook.

Called "Sea Tulang." Near Temerloh.

OLDENLANDIA TRINERVIA, Retz.

Kwala Pahang.

OPHIORRHIZA TRICHOCARPA, Blume.
Passir Loyang.

O. DISCOLOR, R. Br.
Pulau Tiuman.

O. HARRISIANA, Heyne.
Tahan woods, Passir Loyang.

I find these *Ophiorrhizas* difficult to identify. The common Singapore species, which I did not gather in Pahang, has been named by Dr. King *O. succirubra*, from specimens in Mr. Hullett's collection. It, however, differs from the description of this plant in 'Flora of British India' in being very pubescent, as well as in other points. What I have named above *O. discolor* is a rather large plant with glabrous leaves and a finely pubescent cyme; it dries red. *O. Harrisiana* is a smaller plant, with glabrous fruits; some specimens dried red, others green. *O. trichocarpa*, Blume, is very similar, but has hairy fruits. Besides these I met with two other species which are very distinct, but which I could not identify with any description. One was rather a large glabrous plant, found at Kota Glanggi, with long slender branches to the cyme; the flowers rather long, ¼ inch in length. Another, which I have also received from the caves at Kwala Lumpur, is a small shrubby plant, branching, with narrow acuminate leaves; drying reddish.

GREENIA JACKII, Wight.
In thickets by the river at Tanjong Antan. A large shrub, with green flowers.

DENTELLA REPENS, Forst.
Rumpin River, sandy spots.

HEDYOTIS CAPITELLATA, Wall.
Common at and near Pekan. Climbing over bushes.

H. VESTITA, R. Br.
Open country at Katapong, near Pekan and Tanjong Gajah Mati.

A fair-sized herb with lilac flowers. It is called "Rumput Tikus" here (lit. Mouse-grass).

H. AURICULARIA, Linn.
A common woody plant. Pekan &c. A plant with more membranous leaves and less pubescent, which was abundant along the banks of the Tahan and Tembeling Rivers, seems to be a form of this.

H. HISPIDA, Retz.
Kwala Tembeling.

H. PINIFOLIA, Wall.
Common in sandy spots. Kwala Pahang, Pramau, Rumpin, &c.

HEDYOTIS CONGESTA, R. Br.
Common in jungles and thickets. Kadondong, near Pulau Tawar.

H. GLABRA, R. Br.
Common. Temerloh. Called "Leepitum."

POMAZOTA, n. gen.

Herba pusilla, erecta, hispida, 3–4-pollicaris. Folia opposita, lanceolata, acuta vel subacuta, sessilia, integra, hispida, stipulis lanceolatis acutis. Anthela terminalis, capitulum involucratum, hispidum, pedunculatum. Bracteæ involucrales, plures patentes, hispidæ, ovatæ acutæ. Flores minimi, albi rubescentes, sessiles; bracteæ florales binæ ovatæ lanceolatæ, inæquales. Sepala 5, ovata inæqualia, ciliis longis albis tecta. Corolla brevis, tubo superne dilatato superior, lobis 4–5 stellatim patentibus, ovatis acutis, albo-ciliatis, annulo elevato ad faucem tubi. Stamina 4, libera, inclusa, glabra, filamentis linearibus; antheris anguste oblongis, apicibus et basibus emarginatis. Stylus brevis crassus, versus basin articulatus. Stigma rotundatum, bilobum, faucem tubi implens. Ovarium album, costatum, ciliis albis longis tectum; ovula copiosa axillaria. Capsula pyxidata, oblongo-ovoidea, costata, rostrata, operculo dehiscens. Semina copiosissima, angulata, brunnea, punctata, minima.

P. SYLVESTRIS, n. sp. (Pl. LXI.) Herba pauciramosa, hispida, foliis variabilibus, majoribus 3 pollices longis, pollicem latis, atro-viridibus, subtus pallidioribus, omnino hispidis. Pedunculi capitulorum sæpe brevissimi, rarius $1\frac{1}{2}$-pollicares. Flores ferme $\frac{1}{8}$ pollicem, albi, longe albo-ciliati. Calyx ciliis albis, quam sepala longioribus, munitus. Stylus supra ovario articulatus. Pyxis alba.

Plentiful in open pathways in Pulau Tawar woods. A curious little hairy herb with pink buds and white flowers. The capsule opens with an operculum very much resembling that of *Epithema*. The seeds are very minute and abundant.

PETUNGA VENULOSA, Hook.
Kwala Tembeling.

TIMONIUS FINLAYSONIANUS, Wall.
Common shrub, with yellow flowers. Pramau, Pekan.

T., sp.
Kwala Tahan.

A small straggling tree in dense wet jungle, with small yellow flowers on long slender pedicels.

This seems distinct from the two common species, but I cannot match it with any other.

CANTHIUM DIDYMUM, Roxb.
Kwala Pahang, near the old tombs.

CANTHIUM HORRIDUM, Blume.

Bushes in open country. Pulau Tawar, Pulau Chengei, Kwala Berar. A common shrub.

C. ANGUSTIFOLIUM, Roxb., var.?

Kadondong, Pulau Tawar woods.

I am doubtful about this plant, though it does not appear to be rare. I have it also from Sungei Ujong. The young shoots are decidedly pubescent, with a red downy pubescence.

I have several other species of *Canthium* from the Malay Peninsula which are not identifiable with any in the 'Flora of British India.'

MUSSÆNDA MUTABILIS, Hemsl.

Tahan woods.

A very beautiful plant, probably the finest in the genus; rather widely scattered over the Peninsula, and common in some places, as at Kwala Lumpur. It climbs over bushes, but to no great height. The flowers are large, star-shaped, crimson-scarlet, soon becoming orange-yellow.

M. GLABRA, Vahl.

Renchong, and many other places along the rivers.

This is the common Malay Peninsula species. It is not rare to find it with the white calyx-lobes entirely suppressed.

M. VILLOSA, Wall.

Climbing over trees at Kwala Tembeling.

This is a very fine plant, with very large white lobes of the calyx, and rather large flowers for the section. I did not find any fruiting specimen; but though the corollas had fallen, the calyx-teeth, which are rather large, still remained on the young ovary.

ADENOSACME LONGIFOLIA, Wall.

Kwala Tembeling; Tahan River woods.

This is described as a bush with very brittle branches in the 'Flora of British India,' but here it is always a simple herb, at most a little woody at the base of the stem. It inhabits damp rocky hollows in deep jungle.

A. FASCICULATA, Miq.?

An (always?) unbranched shrub, with shiny white stems, and lanceolate acuminate leaves 9 inches long and 2 broad, acute at both ends, tapering into a petiole, drying fuscous, lighter beneath, covered on both sides with short, scattered, appressed hairs; nerves over twenty pairs, usually rather horizontal. Panicle short, terminal, about an inch long. Stipules lanceolate acute. Flowers $\frac{1}{8}$ inch long. Calyx-lobes short, blunt, with large glands. Corolla-tube cylindric, with very short ovate lobes, glandular, pubescent, yellow. Fruit small, globose, not ripe.

This is probably an undescribed species, but I have obtained only a single specimen from Kwala Tahan. It resembles *Adenosacme fasciculata*, Miq., according to the description, in its leaves (except that they are described as strigose only beneath, whereas in this plant they are hispid on both surfaces), and also in the pubescent yellow tubular corolla. *A. fasciculata*, Miq., is a native of Java.

I have also apparently another species of *Adenosacme*, a shrubby branching plant, with stiffer, oblong, quite glabrous leaves, and a much stouter panicle of greenish-white flowers, with large, glabrous, oblong calyx-lobes and oblong stipules. I collected it in the woods at Kwala Tembeling.

UROPHYLLUM HIRSUTUM, Wight.

Common shrub in thick jungle. Temerloh; Tahan River woods; Pulau Tawar. It is called "Yagundi Kayu" here.

U. BLUMEANUM, Wight.

Common. Tahan woods; Pulau Tawar.

U. GRIFFITHIANUM, Wight.

Tahan River.

There are several other species of this troublesome genus which I have not identified.

RANDIA FASCICULATA, DC.

A common shrub, with white flowers; in thickets in open country near swamps. Pekan.

GARDENIA TUBIFERA, Wall.

A small bush, or in Singapore a fairly large tree. The flowers, which open white, almost immediately become orange-coloured, and are very sweetly scented. Banks of the River Pekan.

G. TENTACULATA, Hook.

A small shrub with very bright green leaves and bell-shaped green flowers, with pink spots in the tube. Banks of River Tahan.

G. (§ ROTHMANNIA) CAMPANULA, n. sp. Frutex inermis, ramis griseis (siccitate), subangulatis. Folia in apicibus ramorum congesta, obovata vel obovato-lanceolata, subacuta, tenuia (sicca nigricantia), pubescentia, marginibus ciliatis, 2 pollices longa, pollicem lata. Stipulæ persistentes, ochreatæ, acutæ, pubescentes. Flores majusculi, albi. Calyx tubulosus, $\frac{1}{3}$ pollicem longus, dentibus linearibus subulatis 5. Corolla ferme 2-pollicaris, campanulata, 2 pollices lata, basi angustata, superne abrupte dilatata, lobis 5 vel 6, late ovatis obtusis. Bacca elliptica, ultra-pollicaris, calyce persistente coronata, sicca nigra, intus polita. Semina plura, tenuia, complanata.

Open country at Mahang, Pahang River.

I can find no species described which agrees with this plant. It somewhat resembles some of the South-African species of the genus. I have met with only one bush of it, which was growing at the foot of an *Aporosa* tree in the open meadow land. It would, I think, be well worth cultivating.

IXORA CONCINNA, R. Br.

A small bush, usually, at least, with light orange-coloured flowers. Common in the heath districts. Kwala Pahang, Pramau, Kwala Berar.

I. PENDULA, Jack.

In thick jungle. Tahan River.

Widely scattered over the Peninsula, but never very common. The flowers are not red, as described in the 'Flora of British India,' but white, with pink corolla-tube.

I. AMŒNA, Miq.

Tulomalaty, near Pekan.

I. GRANDIFOLIA, Zoll.

Jungles by the River Tahan.

Flowers white, with pinkish corolla-tubes.

I. STENOPHYLLA. (*Pavetta stenophylla*, Korth. ?)

Korthals described this plant from specimens collected on the banks of the Tewe, at Mount Rankon, Sakumbang, in Borneo. His description is short, but it fairly well fits a plant which is very abundant along the rocky banks of the Tahan River. This is a bushy shrub, about 6 feet high, with lanceolate acuminate acute leaves tapering to both ends, and quite glabrous. The keel on the back of the leaves is prominent, and the principal nerves are arched. The lamina is from 4 to 5 inches in length, and three quarters of an inch wide; the petiole a quarter of an inch long. Stipules setaceous, $\frac{1}{4}$ inch. The corymb of flowers is small and loose, with few branches, bearing only from six to twelve flowers. Bracts ovate acute. Flowers on short pedicels as large as, and resembling those of, *I. fulgens*. Calyx-teeth ovate acute, small. Corolla light orange; the tube slender, $1\frac{1}{4}$ inch long. Petals lanceolate acute, nearly half an inch long. Style exsert, bilobed. The berries usually single, as large as a pea, black, with purple pulp, and one or two grey seeds mottled with purple.

This charming plant is an ally of *I. fulgens* without doubt, but can hardly, I think, be considered an extreme form of this species. I have certainly specimens of *Ixora* approaching this from Larut, in Perak, which has been called *I. fulgens*, var., by the Kew authorities; but though for *I. fulgens* the leaves are remarkably narrow, they are not acuminate at the base, and the corymb of flowers is larger and the petals blunt.

I. CLERODENDRON, n. sp. Suffrutex, parva, pauciramosa, *Clerodendron deflexum* simulans, ramis juvenibus pubescentibus. Folia lanceolata, utrinque acuta vel obovato-acuta, petiolo brevi, 9 pollices longa, $3\frac{1}{2}$ pollices lata, superne glabra, subtus pubescentia (siccata virescenti-brunnea), costa et nervis (9 paribus) prominentibus. Stipulæ subulatæ, basibus triangularibus, pubescentes, $\frac{1}{2}$-pollicares. Cymæ terminales, pedunculis pubescentibus nudis, foliis 2 parvis ovatis sessilibus exceptis, compactæ, pollicem crassæ, ramis brevibus crassis pubescentibus. Flores plures. Sepala linearia, rubra, ferme $\frac{1}{4}$-pollicaria, ovario longiora, pubescentia. Corolla alba, glabra, tubo gracili, pollicari, lobis oblongis ovatis subacutis 4, $\frac{1}{8}$-pollicaribus. Stamina exserta 5, antheris linearibus acutis. Stylus gracilis; stigma clavato-fusiforme. Bacca $\frac{1}{4}$-pollicaris, sepalis persistentibus rubris coronata, succulenta, grisea, rubro-striata. Semina 1–2.

Open woods. Tanjong Antan, Kwala Tembeling, Pulau Chengei; all on the Pahang River bank.

This *Ixora* so much resembles *Clerodendron deflexum* in flowers and habit that it quite deceived me at first. It is allied to *I. Brunonis*, Wall. The white flowers with the red sepals are crowded into a head on an erect terminal stalk, which usually has a small pair of leaves about halfway down. The berries are leaden grey, with pink streaks.

PRISMATOMERIS ALBIDIFLORA, Thw.

A bush with white flowers. Sea-shore, Rumpin River.

PAVETTA INDICA, Linn.

A large bush. Banks of the River Pekan. Common.

MORINDA CITRIFOLIA, Linn.

Sungei Meang. Perhaps wild; common in villages, where it is cultivated under the name of "Mengkudu."

The fruit is given as yellowish in the 'Flora of British India'; here it is of a semi-transparent white.

M. TINCTORIA, Roxb.

A small tree; common. Pekan, Kwala Tembeling.

M. RIGIDA, Blume.

Climbing over bushes. Pramau, Pekan.

Flowers white, deliciously scented.

RENNELLIA SPECIOSA, Hook. f.

Kwala Tenok, on the Tahan River. "Mengkudu Rimbah" of the Malays (*i. e.* Forest Morinda).

GYNOCHTHODES SUBLANCEOLATA, Miq.

A scandent shrub with white flowers and lead-coloured drupes. Common near the sea, Kwala Pahang.

PSYCHOTRIA SARMENTOSA, Blume.

Rumpin River, Kwala Pahang; also Kamposa in Kelantan.

P. STIPULACEA, Wall.

Shrubby plant. Kwala Tembeling. Fruits red.

P. ANGULATA, Korth.

Rumpin River.

PSYCHOTRIA TORTILIS, Blume, var.?
In the Pulau Tawar woods.

P. JACKII, Hook. f.?
Pulau Manis, Renchong.
A big bush, with white flowers and orange berries.

CHASALIA CURVIFLORA, Thw.
Common. Pulau Tawar, Tahan River, Pekan, &c.

The common form of this in Singapore is an insignificant-looking plant with small flowers; but in the interior of Pahang the flowers are much larger and more showy.

GEOPHILA MELANOCARPA, n. sp. (Pl. LXII.) Herba parva, succulenta, glabra, 6–8-pollicaris, caule haud ramoso, basi nuda. Folia 2–4, opposita, erecta, petiolis longis, 3-pollicaribus, superne pubescentibus, lamina ovata cordata subacuta, 2–3 pollices longa, 1–1½ lata, nervis reticulatis. Stipulæ breves, lanceolatæ acutæ. Capitulum pedunculatum, pedunculo bipollicari, foliis breviore. Flores virescentes, ¼-pollicares. Sepala 5, oblonga, obtusa, persistentia. Corolla calycem paullo superans tubulosa, lobis 5 brevibus obtusis. Stamina inclusa 5. Antheræ oblongæ, subacutæ, basi bilobæ dorsifixæ, longitudinaliter dehiscentes; filamenta late linearia plana, ad basin corollæ adnata, superne breviter libera. Stylus complanatus, staminibus subæqualis. Stigma breviter bilobum. Discus columnaris magnus. Bacca globosa, succosa, atra, nitida, circiter ¼ pollicem crassa, calyce persistente coronata. Semina 2, ossea, ⅜-pollicaria, ovalia, uno latere convexo, costa mediana, altero plano, costa vix elevata. Albumen album, corneum.

Woods and limestone rocks, Kota Glanggi, Tahan woods; also at the limestone caves of Kwala Lumpur, in Selangor.

Though very different in appearance from *G. reniformis*, I am disposed to place this curious little plant here. It is a very succulent little herb, growing deep in the ground, sporadically in woods, especially in limestone districts. It is remarkable for the great length of its internodes, the pairs of leaves (one or two) being often 3 inches apart; but usually the lower pair has fallen off before the upper ones appear, so that there is only one pair at a time. The berries are very juicy and deep black, like black currants, but shiny.

G. RENIFORMIS, D. Don.
Damp woods near the caves at Kota Glanggi.

This plant is commonly called "Pegaga Ular" by the Malays, *i. e.* Snake's Hydrocotyle, from its resemblance to *Hydrocotyle asiatica*, Linn.

CEPHAËLIS GRIFFITHII, Hook.
Common in jungles at Palau Tawar, Kota Glanggi, and on the Tahan River.
A sweet-scented plant, with honey-yellow flowers and bright blue berries.

LASIANTHUS CYANOCARPUS, Jack.
Sandy woods at Rumpin; and several other species also occur in the Pahang woods.

HYDNOPHYTUM FORMICARIUM, Jack.
Common at Kwala Pahang.

MYRMECODIA ECHINATA, Jack.
With the last, but much scarcer.

PÆDERIA FŒTIDA, Linn.
Scrambling over grass and bushes at Ayer Hitam and other places near Pekan.

SPERMACOCE HISPIDA, Linn.
A common weed, with pink flowers, in sandy places. Pekan, &c.

COMPOSITÆ.

VERNONIA ELEAGNIFOLIA, DC.
Pekan.

This is common on the banks of the river in the town. It forms a large bush with lavender-coloured flowers, but is hardly a climbing plant here, as it is described in the 'Flora of British India,' vol. iii. p. 337. It has a habit of emitting shoots from the roots, and is easily propagated from cuttings in this way. It has not hitherto been recorded from the Malay Peninsula, but only as a native of Burmah and Siam.

V. ARBOREA, Ham.
Not rare. Pekan, Kwala Tembeling,

A tall slender tree, about 40 feet high, with pale bark, or, not rarely, more stunted and gnarled; leaves sometimes quite glabrous (Kwala Tembeling), oftener woolly beneath (Pekan).

V. CHINENSIS, Less.
A common village weed, Pekan, &c. Also Kamposa in Kelantan.

V. CINEREA, Less.
Common. Pekan, Pulau Manis, &c.

ADENOSTEMMA VISCOSUM, Forst.
Pulau Tiuman, Blay Manis, Pahang River. A common weed.

MIKANIA SCANDENS, Willd.
Open grassy country near Pekan, scrambling under bushes.

ERIGERON LINIFOLIUS, Willd.
This weed has already found its way as far into Pahang as Pulau Jellam, on the Pahang River.

BLUMEA LACERA, DC.
Open grassy country. Pekan, Kwala Tembeling.

B. BALSAMIFERA, DC.
Very common in open country all along the Pahang and Tembeling Rivers, and at the mouth of the Tahan.

This is known everywhere as "Sumbong" by the Malays and is used by them in medicine. By distilling the leaves a clear green oil can be obtained with a strong camphoraceous odour.

SPHÆRANTHUS MICROCEPHALUS, DC.

Damp spots. Sungei Meang, Katapong near Pekan.

ECLIPTA ALBA, Hassk.

A common weed in waste ground and river-banks. Pekan, Renchong, &c.

WEDELIA BIFLORA, DC.

Common in wet spots on the sea-coast, Sungei Meang, Cherating River; also in thickets far up the Pahang River, but less frequently, as at Tanjong Antan.

SPILANTHES ACMELLA, Linn.

Common by paths and in waste ground. Sungei Meang, &c.

AGERATUM CONYZOIDES, Linn.

Common. Blay Manis, &c.

SONCHUS ASPER, Hoffm.

Waste ground. Sungei Meang, &c.

CAMPANULACEÆ.

PENTAPHRAGMA BEGONIÆFOLIUM, Wall.

Tahan River, on rocks, and also far in the woods, in rocky valleys, common.

GOODENOVIEÆ.

SCÆVOLA KŒNIGII, Vahl.

Common on the sea-coasts. Rumpin River; Kwala Pahang.

VACCINIACEÆ.

VACCINIUM MALACCENSE, Wight.

A large shrub with very sweet-scented rosy or white flowers. Berries small, globose, dark plum-coloured, eatable.

Plentiful in sandy spots at Pramau, opposite Pekan.

V. SABULETRUM, n. sp. Arbuscula magna, pulchra, cortice nigro. Folia ovata lanceolata, petiolata, basi rotundata, apice acuta vel acuminata, subcoriacea, nervis (in sicca) distincta, marginibus integris, sæpe rubra, 2 pollices longa, pollicem lata, petiolo ¼-pollicari. Racemi plures, axillares atque terminales, 2–2½-pollicares. Flores 10–12 in racemo penduli secundi rubro-rosei, pedicellis rubris, ¼-pollicaribus. Bracteæ caducæ. Calyx campanulatus, dentibus brevissimis triangularibus. Corolla ½-pollicaris rubra tubulosa, basi dilatata, dentibus brevibus ovatis triangularibus obtusis recurvis. Stamina 8, antheræ breves, oblongæ, ecalcaratæ, loculis disjunctis, appendicibus longissimis quam filamenta longioribus; filamenta tenuia, plana, basibus pubescentibus et incrassatis. Stylus crassus, rectus, cylindricus, apice obtuso, corollam haud superans. Bacca parva, nigra, ferme glabra.

Sandy places with the preceding, but much less frequent. A very pretty bush, distinguished from *V. malaccense* by its very different-shaped flower, coriaceous leaves, which are often bright red, and the very long appendages to the stamens, which are as long as the whole of the rest of these organs.

I cannot match it with any other Indian or Malayan species, nor have I seen it elsewhere. It is deliciously scented, and the berries, like those of the preceding, are very good and sweet.

MYRSINEÆ.

MÆSA RAMENTACEA, A. DC.

Temerloh, in thickets.

M. INDICA, Linn.

Pulau Chengei, Tanjong Antan, Tahan River.

In dense thickets. Fruits cream-colour, flowers white.

I am not very well satisfied with my identification of these plants. What I take to be *M. ramentacea*, A. DC., and what has been so named by the authorities at Kew, is a far-climbing shrub (not a tree of 30 feet in height as described in the 'Flora of British India') with slender branches, and usually ovate lanceolate leaves. It is very liable to the attacks of some insect, which converts the inflorescence into a mossy-green mass of abortive branchlets, which is really much prettier than its small white flowers. It is an exceedingly common plant in Singapore. The other plant, which I suppose to be *M. indica*, Wall., is also, at least sometimes, half-scandent, but I have seen it also in the form of a small tree; the leaves are much larger and more elliptic, the inflorescence smaller. It is much less common.

MYRSINE CAPITELLATA, Linn.

Shores, Kwala Pahang.

LABISIA POTHOINA, Lindl.

Common in woods. Pekan, Tahan River.

This plant is very variable in the form of leaves, but most of the forms to which names have been given are really states rather than varieties. Young plants have the leaves crenulate, very dark green in the centre, with a pink edge, but they soon lose this colouring and become entirely green and with an entire edge. The flowers are not usually white, as described in 'Flora of British India,' but pink, the berries scarlet.

ARDISIA COLORATA, Roxb.

A shrub, usually small and straggling (var. *complanata*), with small leaves. Inhabits thick woods.

——, var. **COMPLANATA**.

Pekan (*Dr. Haviland*).

——, var. **POLYNEURA**.

Thickets. Tahan River.

ARDISIA LANCEOLATA, Roxb.

Woods at Kadondong, Pulau Tawar.

Found only once in fruit. The leaves are not usually, strictly speaking, parallel-sided. The sepals are unusually large in proportion to the berry.

A. CRENATA, Roxb.

Very common round Pekan and elsewhere.

This is the real "Mata Palandok" (Mouse-deer's eyes) of the natives, though the name is often applied to other *Ardisias*. It usually forms a small, often compact, bush, with rose-pink flowers and scarlet berries, very sweet and eatable.

A. VILLOSA, Roxb.

Woods at Kota Glanggi and Pulau Tawar. Common.

A very charming small shrub, with a dark pink calyx, a lighter pink corolla, and scarlet berries.

A. ODONTOPHYLLA, Wall.

Not common. Pulau Tawar. Flowers pink.

A. OXYPHYLLA, Wall.

Kwala Luit, Temerloh. Flowers rose-colour.

A. SOLANACEA, Roxb.

Common on the sea-shore at Kwala Pahang and Pulau Tiuman, and also met with at Kamposa in Kelantan.

The oldest name for this is *A. humilis*, Vahl, a peculiarly unfortunate one, as it is the largest species of *Ardisia*, at least, to be met with in these regions. The flowers are rose-coloured, the berries black.

ÆGICERAS MAJUS, Gærtn.

Sungei Meang.

SAPOTACEÆ.

SIDEROXYLON FERRUGINEUM, Hook.

Small tree on the sea-shores. Pulau Tiuman; Kwala Pahang.

PALAQUIUM GUTTA, Burck.

Trees without fruit or flower were seen in several places in the Tahan woods.

A considerable quantity of gutta-percha is still collected by the Sakais in these woods and sold to the Malays.

PAYENA, sp. "Jatohtoh."

Woods at Pulau Tawar. A tree found in fruit only.

EBENACEÆ.

MABA BUXIFOLIA, Pers.

A small tree at Kwala Pahang.

This is one of the trees which produces good ebony in the Malay Peninsula; it is called "Kayu Arang."

DIOSPYROS LUCIDA, Wall.?

Of three specimens of this tree sent to Kew and Calcutta, two were named *Diospyros* aff. *ebenum* and *flavicans*, the third was named *D. lucida*; one of the former was collected in open country at Pekan, where it formed a good-sized tree with white flowers. It is by no means rare in the Peninsula, and is also known as an ebony-tree.

D. CALIGINOSA, n. sp. Arbor elata, gracilis, cortice atro, ramis pubescentibus. Folia alterna, elliptica, oblonga acuta, petiolata (sicca brunnea), 8 pollices longa, 3 pollices lata, nervorum 13 paribus, supra glabra, subtus costa et nervis minute pubescentibus, petioli $\frac{1}{4}$-pollicares, minute pubescentes. Flores e ligno vetusto copiosa congesta, pedunculis brevibus pubescentia nigra tectis. Masculi calyx patelliformis; sepala 4, late ovata obtusa, exteriore et margine capillis atris tecta. Corolla urceolata alba sericea, $\frac{1}{4}$-pollicaris, lobi recurvi 4, breves ovati. Stamina 16, per paria aggregata, filamentis quam antheræ breviora, crassa, minute hispida, antheris glabris elongati conicis, apicibus acutis. Ovarium abortivum, 4-lobum, irregulare, lobis canaliculatis. Stylus conicus. Flores feminei non visi. Fructus (valde putridus solummodo visus) parvus, globosus, sepalis incrassatis cinctus.

In thick woods at Kota Glanggi and Kwala Tembeling.

I only found male flowers of this tree, but I saw the remains of the fruit, in too rotten a state to preserve, still *in situ*, among the male flowers. It is evidently allied to *D. cauliflora*, Blume, but that species differs in its oval glabrous leaves narrowed at both ends, axillary male flowers, and other points.

D. ARGENTEA, Griff.

A small tree in thick jungle. Tahan woods.

The dry leaves of this plant are burnt by the Malays to drive away mosquitoes from their houses. They make a crackling sound, which is supposed to frighten insects away; hence the plant is called "Mulatope Api" (fire-cracker) or "Mulatope Lalat" (fly-cracker).

STYRACEÆ.

SYMPLOCOS FERRUGINEA, Roxb.

A beautiful tree, producing numerous panicles of white flowers. Pramau heaths, Pekan.

OLEACEÆ.

JASMINUM PUBESCENS. Willd.

Not common. Pekan.

Jasminum bifarium, Wall.

A variety with exceedingly short calyx-teeth. Tanjong Gajah Mati, Pahang River, and Kwala Tembeling.

J. Maingayii, C. B. Clarke?

On the sea-shore at Tringganu.

This may be distinct. It has larger flowers than any other species I have gathered here. Leaves coriaceous, glabrous, with fairly long petioles. I have never seen this anywhere else.

Olea maritima, Wall.

A common bush on the sandy heaths of Pramau and Kwala Pahang.

Apocynaceæ.

Willughbeia edulis, Roxb.

Fruits of what appeared to be this species were found upon the ground in the Tahan woods. They were globose and of a pale orange-colour, with pink seeds, and like all, or nearly all, the *Willughbeia* fruits, eatable.

Big lianes of this, or perhaps *W. Burbidgei*, often barred the way through the jungles.

W. dulcis, n. sp. Scandens, haud magna, ramis gracilibus nigricantibus. Folia opposita, petiolata, obovato-oblanceolata, sæpissime obtusissima, rarius acuminata, basi acuta, marginibus undulatis, atro-viridia (sicca atro-brunnea), superne vix nitida, subtus pallidiora, nervorum 28–30 paribus transversis vel paullo ascendentibus, 3 pollices longa, pollicem lata, petiolus ¼-pollicaris. Cymæ parvæ, compactæ. Bracteæ ovatæ subacutæ. Flores flavi, ½-pollicares, pedicellis brevibus. Calyx brevis; sepala ovata obtusa, marginibus ciliatis, reliqua glabra. Petala tubo multo longiora, lorata, marginibus præsertim ad basin ciliatis, tubo abrupte dilatato ad apicem, squamæ in fauce nullæ. Stamina filamentis brevissimis flexuosis, antheræ conicæ acutæ. Stylus brevis, gracilis. Stigma acuminatum pubescens. Ovarium conicum. Bacca elliptica, obtusa, 3 pollices longa, 1¼ pollices lata, armeniaca.

Pramau, near Pekan.

A slender liane, climbing over and through bushes, full of gutta. This is the best eatable *Willughbeia* fruit I have met with. The fruits, which are apricot-coloured, are soft and sweet, but the large quantity of gutta in them interferes much with the eating of them. The species is called "Buah Padang" by the natives; the most nearly allied species to it is *W. tenuiflora*, Dyer, which, however, has pubescent shoots and cymes, and a hemispheric ovary becoming a pyriform fruit.

Chilocarpus Maingayii, Dyer.

Temerloh.

Rauwolfia serpentina, Benth.

In villages and waste ground under trees at Pekan and Pulau Tijau; also found at Tringganu.

Cerbera Odollam, Linn.

Common on the sea-coasts, Rumpin River, Cherating, and Kwala Pahang. Commonly known to the Malays as "Buta-Buta" (lit. blind, on account of its latex producing blindness if dropped into the eyes).

Kopsia, sp.

I collected at Pulau Tiuman what seems to be a new species of this small genus. It is quite a low plant, exceedingly laticiferous, with pure white flowers, but defer describing it till I can obtain further specimens.

(K. fruticosa, A. DC.

Stated in books to be a native of Singapore; only occurs there in gardens. There is a wild species at Chan-chu-kang, however, dried specimens of which may be taken for it. It is less woody and has pure white, not pink, flowers.)

Vinca rosea, Linn.

Has thoroughly established itself on sandbanks at Tringganu, covering them thickly in parts.

Dyera costulata, Hook. f.

Trees out of flower of the "Getah Jelutong" were seen in the Tahan woods.

Ichnocarpus ovatifolius, DC.

Pulau Manis and Kwala Tembeling.

Aganosoma marginata, G. Don. Tanjong Antan.

Known as "Sakat Limah," and used in native medicine for rheumatism.

Asclepiadeæ.

Streptocaulon Wallichii, Wight.

An exceedingly laticiferous plant, climbing over small trees. Kamposa in Kelantan.

Tylophora asthmatica, Wight & Arn.

Sea-shores, Tringganu and Kwala Pahang.

Marsdenia, aff. M. tinctoria, R. Br.

Differing in its flowers being glabrous within. Pulau Chengei.

Dischidia.

The plants of this genus disappear to a large extent as one advances into the interior of the country, and are absent from the thick jungle.

D. Rafflesiana, Wall.

On the heaths near Pekan and Kwala Pahang. This species is typically a sea-coast plant, very abundant in dry spots near the sea, and disappearing inland. I met with it again, however, on Mount Ophir, in Malacca.

D. hirsuta, Decne.

Pramau, near Pekan. Common.

DISCHIDIA NUMMULARIA, R. Br.

Heath country at Kwala Pahang.

I imagine this is the plant Griffith described under the name of *D. albida*. which, he says, was common on trees at Malacca, as *D. nummularia*, Br., certainly is. The 'Flora of British India' gives the colour of the flowers as *red*, but they are white. Rumph's figure (Herb. Amboin. v. t. 176. fig. 1) evidently represents this common plant, and he describes the flowers as "virentes." The leaves differ very much in the length of the petiole, which, indeed, is often absent.

It is a most noxious epiphyte in Singapore, draping and eventually killing trees.

What I take to be the "*D. albida*, Griff.," of the 'Flora of British India,' is quite a different plant. It is only recorded there from "Toondook." This is probably Gunong Toondook, a peak of the Ophir range. *D. nummularia*, R. Br., I never saw there; but a species growing in that locality fits the description in the 'Flora' fairly well, and is probably the *D. albida* of that work, but not of Griffith.

D. BENGHALENSIS, Colebr.

Kota Glanggi woods and Kalambalai, near Pekan.

CRYTOCERAS REFLEXUM, Benn. (*Hoya multiflora*, Blume.)

Only met with on Pulau Tiuman, where it was brought to me by a Malay. It is evidently a very local plant. I have it also from Perak. The plant is not a climber, as stated in the 'Flora of British India,' but an epiphytic shrub.

HOYA LATIFOLIA, Don.

Kota Glanggi woods.

H. PARASITICA, Wall.

Pramau, near Pekan.

H. CORONARIA, Blume.

Kwala Pahang, Kwantan.

This is the commonest species of *Hoya* in the Straits. It very rarely produces fruit, but I have found the capsule twice in the same place, viz. at Pulau Tekong, between Singapore and Johore. Sir J. Hooker suggests, from the different colours of the flowers as described by Maingay and others, that there may be two species mixed here, a purple and a white-flowered one; but the diversity of colour as described is only the effect of difference of age of the flower. The blossoms, when they first open, are greenish white; they then become of an ivory-white, with a somewhat creamy tint; a little later irregular madder-pink spots appear here and there, after which the whole flower becomes dark pink and then commences to fade or falls off.

H. DIVERSIFOLIA, Blume.

Kwala Pahang. Flowers rose-colour.

H. CORIACEA, Blume.

Pekan. Flowers yellow.

SPILADOCORYS, n. gen.

Herba parva, simplex vel a basi ramosa, ramis erectis. Folia opposita, lanceolata acuminata, apice subobtusa, petiolata, tenuia. Racemi breves, axillares et terminales. Bracteæ lanceolatæ acutæ, persistentes. Flores parvi, breviter pedicellati, albi. Sepala 5, ovata subacuta. Petala lanceolata, apicibus subulatis. Squamæ coronæ carnosæ, petalis alternantes et iis ad basin solummodo adnatæ, obcuneatæ truncatæ, apicibus incrassatis, processibus brevibus. Stamina connata, apicibus tenuibus linearibus, acuminibus erectis, loculis 2. Pollinia singula in loculis oblongo-ovoidea, ad apices glandula oblonga rubra adnata, aurantiaca, cerea, punctata. Stigma subglobosum. Capsula $1\frac{1}{2}$-pollicaris, angusta teres, viridis, lævis, pedicello elongato, sepalis incrassatis. Semina complanata, oblonga minima, coma magna sericea.

S. ANGUSTIFOLIA, n. sp. (Pl. LXIII.) Herba rupestris, vix ultra-pedalis. Folia 3 pollices longa, $\frac{1}{8}$–$\frac{3}{8}$ pollicem lata, basi angustata, petiolo brevi, tenuia, læte virentia. Flores albi, pedicellis $\frac{1}{4}$-pollicaribus. Petala æquilonga.

On rocks in the Tahan River, also at Waterfall Hill, Larut Hills, near Thaiping (Perak). Abundant at a few spots.

Allied to *Pentabothra* apparently. The coronal scales are almost quadrate-obcuneate, the tops thickened and ending in a number of short processes.

GENTIANACEÆ.

LIMNANTHEMUM INDICUM, Thw.

Pools on the heaths. Kwala Pahang.

L. AURANTIACUM, Dalz.

With the last. A charming little plant, which, with its bright yellow flowers and orbicular waved leaves, reminds one at once of the Celandine.

BORAGINEÆ.

COLDENIA PROCUMBENS, Linn.

Pekan.

HELIOTROPIUM INDICUM, Linn.

Common round Pekan and in other waste spots near houses up the river.

LOGANIACEÆ.

MITRASACME POLYMORPHA, R. Br.

Plentiful on sandy heath country at Pramau, opposite Pekan.

FAGRÆA AURICULATA, Jack.

A very large shrub or small tree. Woods in the heath-country opposite Pekan.

The dimensions of the flower and fruit given in the 'Flora of British India' are much under the real size, and are evidently taken from dried specimens, in which the flower is much shrunk. Miquel's figure (*F. imperialis*, Ann. Mus. Lugd. Bat. ii. t. 5) is not at all exaggerated. The fruit is seven or eight inches long, conical, blunt, with the style

remaining for a long time; the base is closely clasped by the enlarged calyx. It is of that peculiar grey colour which is possessed also by others of the genus. The fruit takes a very long time to ripen; when ripe it splits at the top into several lobes, which curl back and expose the very minute seeds lying in a yellowish pulp.

FAGRÆA OBOVATA, Wall.

Common on sandy heaths at Pramau, opposite Pekan.

A small tree throwing up many very yellowish-green shoots from the roots.

F. RACEMOSA, Jack.

Pekan, Kwala Tenok, on the Tahan River; also at Pulau Chengei.

A large shrub or straight-stemmed tree, with loose bark peeling off in shreds. Flowers flesh-colour.

It is common all over the Peninsula in damp open ground, and is called "Sapooli."

CYRTOPHYLLUM FRAGRANS, Blume. (*Fagræa fragrans*, Roxb.)

Common on sandy heaths between Pekan and Kwala Pahang. It grows in similar places at Changi, in Singapore, and in other parts of the Peninsula, and here I am sure it is native; but now it is spread everywhere in dry open soil, partly diffused by birds, and being also very commonly planted as a shade or ornamental tree. The flowers are yellowish white, very sweet-scented, especially in the evening, when they are visited by innumerable butterflies, of the Hesperidæ section, and humming-bird hawk-moths (*Macroglossa luteata* and *M. insipida*). The larva of one of the Sphingidæ (*Protoparce orientalis*) feeds on the leaves. The berries are bright orange, and it is difficult to say whether the tree is more beautiful when covered with flowers or fruits.

This is the true "Kayu Tembusu," or more correctly "Tembusé," but the Malays give the name often to other *Fagræas* and *Cyrtophyllums*.

STRYCHNOS LAURINA, Wall.

Pigang, Pahang River. Called here "Semijo Akar."

S. TIEVTE, Blume.

Occurs throughout Pahang, but I have no specimens.

This common plant is not mentioned in the 'Flora of British India.' It is one of the species of *Strychnos* used by the Sakais for mixing with Ipoh (*Antiaris toxicaria*, Blume), for poisoning arrows.

I have no doubt as to the correctness of the identification of this with Blume's plant, though his figure gives the fruit as reddish-coloured. All over the Peninsula it is of a curious greyish green.

CONVOLVULACEÆ.

LETTSOMIA MAINGAYII, C. B. Clarke.

Kota Glanggi woods.

Climbing high up on the trees. This plant, though by no means common, is widely scattered in the Peninsula. The flowers are tubular and violet-purple, the plaits of the limb being white. It is a very pretty species.

IPOMŒA UNIFLORA, Roem. & Schult.
Hedges and thickets. Pekan, and also at Kamposa in Kelantan. Flowers white.

I. ANGUSTIFOLIA, Jacq.
Common. Pekan, and on all the sandbanks up the rivers.

In grass and thickets it is extensively climbing; on the sandbanks it forms rosettes, sending out long trailing stems. The flowers are cream-coloured (not yellow), with a maroon eye.

I. LINIFOLIA, Blume.
Less common than the preceding, but plentiful at Katapong and other places round Pekan.

This is much more of a creeping plant than the preceding, but twines in long grass. In short turf it is quite prostrate; the flowers of a bright primrose-yellow.

I. CHRYSEIDES, Ker.
Extensively climbing and covering bushes on the sandy islets in the Rivers Tembeling and Pahang. Flowers rather small but numerous, of a bright yellow. A fasciated specimen was found at Kwala Tembeling.

I. DENTICULATA, Choisy.
Sandy spots beneath the Casuarinas. Rumpin River; Kwala Pahang. Flowers pink rather than purple, the colour of those of *I. biloba*, Forsk.

I. CYMOSA, Roem. & Schult.
Near Pekan. Not very common here; flowers bright yellow.

I. BILOBA, Forsk. (*I. Pes-capræ*, Roth.)
The "Tapak Kuda" (Horse-footprint) of the natives is common on all the sea-coasts of Pahang, wherever the soil suits it.

I. CARNOSA, R. Br.
Creeping in sandy spots beneath the Casuarinas at Rumpin River. Flowers white.

I. VITIFOLIA, Sweet.
Common on the sandy islands and sandbanks of the Pahang and Tembeling Rivers, but flowers only once met with, viz. at Lubu Pelang.

SOLANACEÆ.

SOLANUM VERBASCIFOLIUM, Linn.
A big shrub with white flowers. Pulau Manis, Pulau Tawar.

S. FEROX, Linn.
Pulau Manis.

SOLANUM INDICUM, Linn.
Cultivated and half-wild, common in Pulau Tawar and Pekan.

S. MELONGENA, Linn.
Cultivated.

S. MAMMOSUM, Linn.
Common in villages and open ground. Pekan, Pulau Jellam.

This is not recorded at all in the 'Flora of British India.' It may be a recent introduction, as it is a native of the West Indies and South America. Now, however, it is very common in the Peninsula, and forms a conspicuous part of village scenery in Malacca, Sungei Ujong, &c. It has also received a native name.

S. ACULEATISSIMUM, Jacq.
Open ground, Pulau Tawar. Also collected at Kamposa in Kelantan.

PHYSALIS MINIMA, Linn.
Open country, Pekan.

CAPSICUM FRUTESCENS, L., and even more commonly C. MINIMUM, Roxb., are cultivated everywhere.

SCROPHULARINEÆ.

ADENOSMA CAPITATUM, Benth.
Hot dry places. Pramau, Pekan. A very aromatic plant with blue flowers. The Malays call it "Kuching-Kuching" (literally, Cats).

A. CÆRULEUM, R. Br.
Dry places, roadsides, &c., rather common. Katapong, Pekan, Pulau Jellam, Tanjong Gajah Mati. Flowers pale lilac-blue.

LIMNOPHILA CONFERTA, Benth.
Muddy spots on the edges of swamps. Pekan. Flowers blue. This form, says Dr. King, is *L. serrata*, Gaudich. Not recorded previously from the Peninsula.

L. MICRANTHA, Benth.
Muddy swamp, Kwala Pahang. Also not hitherto known from the Peninsula.

HERPESTIS MONNIERA, H. B. & K.
Blay Manis and other places in Pahang; Kamposa in Kelantan. Common in ditches and damp spots all over the Peninsula. A very aromatic little plant.

ARTANEMA SESAMOIDES, Benth.
Wet places, Mahang, Pulau Tijau.

A very pretty plant with fairly large violet flowers with darker markings. More rarely the flowers are nearly white.

Curanga amara, Juss.

Common in dry spots, edges of woods, and pastures. Pekan, Pulau Tijau, Renchong, Tahan River.

The flowers are white, often tinted with pink; stamens orange. It is called "Mempada Tanah," and is used by the Malays in liver complaints.

Torenia polygonoides, Benth.

Dry spots, Passir Loyang, Tahan River. Very common in Singapore and Malacca.

Vandellia crustacea, Benth.

Very common, Pekan &c.

It varies somewhat in colouring of flowers and size and form of leaves. I have seen quite a fleshy form on the sandy heaths of Pramau.

V. hirsuta, Benth.

Not common. Heaths at Kwala Pahang.

V. scabra, Benth.

Borders of a wood, and open country, Pulau Chengei.

Bonnaya brachiata, Link.

Rather dry spots, Katapong, near Pekan, &c. Flowers violet.

B. veronicæfolia, Spreng.

Pekan, Pulau Jellam.

Scoparia dulcis, Linn.

Very common in all the open country. Wherever the buffaloes go, this plant follows; and as it often grows from the dung of these animals, I believe that they eat it and pass the seeds. It is a native of America, and, according to the 'Flora of British India,' the earliest Indian record for it is 1845 at Serampore in Bengal (?), where Voigt collected it. It is now abundant in Bengal; but no one seems to have collected it but Mr. Clarke, nor had any specimens been sent to England from the Straits in 1884. Now, however, it is exceedingly common over all the Peninsula as far as I have been, and has even received a Malay name, viz. "Te Macao," *i. e.* Macao tea (in Malacca), it being used to make tea of. In Pahang it has travelled further than any other South-American introduction except *Paspalum conjugatum*, Berg.

Striga lutea, Lour.

Pekan; common in dry grassy spots. The Pahang form has yellow flowers, while those of Singapore are pink.

BIGNONIACEÆ.

Oroxylum indicum, Vent.

Common on the banks of the river, from Pekan up.

It is most commonly to be seen in and round villages, but apparently is not planted, as the natives have no use for it. Some of the islands are nearly covered with it. The flowers here are of a dull brownish purple.

STEREOSPERMUM FIMBRIATUM, DC.

Not common. Collected at Pekan by Dr. Haviland. The Malays in Malacca call it "Cha-Cha."

S. GLANDULOSUM, Miq.

A small bushy tree with pale pinkish-white flowers. Near Kwala Tenok, on the Tahan River.

DOLICHANDRONE RHEEDII, Seem.

Mangrove-swamp, Kwala Brawas, near Kwala Pahang.

PEDALINEÆ.

SESAMUM INDICUM, DC.

A weed here and there, on sandy banks in the Tembeling River.

LENTIBULARIEÆ.

UTRICULARIA FLEXUOSA, Vahl.

Pools on the heath at Kwala Pahang.

U. BIFIDA, Linn.

Damp sandy spots at Kwala Pahang.

This is the commonest species of this section here. It is very plentiful in ditches in sandy country in Singapore.

U. PUNCTATA, Wall.

Chenei Lake (*W. Fox*). Flowers pale blue.

U. VERTICILLATA, Benj.

Same locality.

U. RACEMOSA, Wall.

Plentiful in some places at Kwala Pahang.

A charming little plant, with pure white flowers like a miniature lily of the valley. It is to be met with also on the sandy open country between Tana Merah and Changi in Singapore.

U. MINUTISSIMA, Vahl?

A minute species with small mauve-pink flowers. Vahl's description (Enum. i. 204) is so meagre that one cannot be at all sure what was intended. His plant was collected by Koenig in Malacca; but the only common blue-flowered species I have seen there was *U. affinis*, var. *Griffithii*, of which, however, one can hardly say that the stem is "capillaris" even in stunted specimens. On the other hand, this very delicate plant from Pahang has mauve-pink, not, strictly speaking, blue flowers.

CYRTANDREÆ.

ÆSCHYNANTHUS LOBBIANA, Hook.

Kwantan, Pekan.

The commonest species in the Peninsula.

Æ. LONGICAULIS, Wall.

Pulau Manis.

ÆSCHYNANTHUS RADICANS, Jack.

On trees overhanging the Tahan River.

Æ. LONGIFLORA, DC., var. ?

The calyx is remarkably hispid, otherwise the plant appears the same. Woods, Tahan River.

DIDYMOCARPUS KOMPSOBŒA, C. B. Clarke.

Damp wooded streams in the Tahan Valley.

This plant has much the appearance of *D. platypus*, C. B. Clarke, but the flower is broader and rather shorter in proportion, and the capsule is shorter and thicker. The flowers are white, with yellow markings in the throat. I have it also from Bukit Hitam in Selangor, and from Sungei Hudang in Malacca.

D. CRINITA, Jack ?

A number of plants of a species allied to this, if not identical, were found at Kwala Tenok, in the Tahan woods. The leaves were of a deep malachite-green, with a pale central bar. It was a very ornamental foliage plant, but I could not find any flowers. *D. crinita*, Jack, is abundant on Penang Hill and on the Larut Hills. It has pale blue flowers, and is certainly closely allied to *D. platypus*, C. B. Clarke, a much broader-leaved plant, with white, rarely bluish, flowers, which is common in Singapore and Malacca.

D. QUINQUEVULNERA, n. sp. Caulis 6–9-pollicaris vel brevior, raro ramosus, ligneus, tomento brunneo tectus. Folia lanceolata acuminata acuta, serrata, basi angustata, sericeo-pubescentia, atro-viridia, 6 pollices longa, 2–2½ pollices lata. Flores plures in racemis brevissimis, pedunculis gracilibus roseis albo-ciliatis, speciosi. Sepala 5, lanceolata acuta, viridia. Corolla tubo gracili superne dilatato, 3 pollices longo, albo, limbo bilabiato flavo, lobis 5, rotundatis, kermesinis vel violaceo-purpureis, marginibus albis, striis aurantiacis in fauce tubi. Stamina glabra, 2 sterilia, gracilia, alba, antheris nullis; 2 fertilia, crassiuscula, alba, sinuata, antheris reniformibus, canaliculatis, connatis, connectiva producta obtusa. Ovarium in stylo attenuatum, pubescens, viride. Stylus pubescens, crassiusculus. Stigma cordatum. Capsula gracilis, cylindrica, acuminata, 3½-pollicaris.

Kota Glanggi woods; Tahan woods.

A very beautiful plant, well worthy of cultivation. There are two forms of this. In the Kota Glanggi woods the lobes of the corolla are crimson edged with white, but in the Tahan Valley this colour was replaced by a lovely dark violet-purple.

D. ATROSANGUINEA, n. sp. Caulis lignosus ad 6-pollicaris, ¼ pollicem crassus, basi sæpius nudus. Folia lanceolata acuta crenulata, basi lata denticulata vel dentata, 9 pollices longa, 4 pollices lata, superne atro-viridia, velutinoso-pubescentia, multinervia, nervis depressis ascendentibus, subtus glaucescentia pubescentia, costa et nervis elevatis, nervulis reticulatis. Racemi axillares brevissimi, pauciflori. Flores speciosi, atro-sanguinei, pedicellis 3-pollicaribus pubescentibus, bractea mediana ovata. Sepala 5, linearia acuta, ¼-pollicaria, rubra, pubescentia. Corolla pubescens, tubo 2-pollicari

versus os incrassato, lobis 5 subæqualibus, ovatis obtusis, atro-sanguineis, tubo intus flavo. Stamina inclusa 2 sterilia, filamentis albis gracilibus, anthera nulla; 2 longiora filamentis albis, glabris, crassiusculis, sinuosis, appendice obtusa distincta, antheræ subæquilonga, antheris connatis, flavescentibus, semiovatis. Stylus stamina superans, versus apicem attenuatus, albus, pubescens. Stigma integrum rotundatum, centro depresso.

Tahan woods. Also brought by natives from Tringganu, north of Pahang.

A lovely plant, closely allied to *D. quinquevulnerus*, but distinct in the softer pubescence of the leaves, colour of the flowers, and form of anthers and stigma.

DIDYMOCARPUS FLAVOBRUNNEA, n. sp. Caulis gracilis, raro ramosus, dense pubescens, haud ligneus, 3–4-pollicaris. Folia alterna, petiolata, petiolo pollicari, crassiusculo, pubescenti-hispido, lamina ovata vel ovato-lanceolata acuta, basi angustato cuneato, margine serrato, 7 pollices longa, 3 pollices lata, nervis et costa subtus prominentibus ciliis brunneis lucidis tectis, supra sparse pubescentia, fasciculis ciliorum in dentibus marginalibus. Pedunculi axillaribus 8 pollices longi, erecti, rigidi, hispidi, superne dichotome ramosi, ramis brevibus subæqualibus, congestis. Flores plures, $\frac{1}{2}$-pollicares. Bracteæ lanceolatæ acuminatæ, $\frac{1}{4}$-pollicares, hispidæ. Pedicelli breves. Calyx profunde fissus, laciniis 5 angustis linearibus pubescentibus. Corolla pollicaris, tubo basi cylindrico, apice dilatato, lobis inæqualibus 5 rotundatis, tubus extus castaneo-brunneus, lobis flavis aut albescenti-flavis, macula aurantiaca in fauce, striis rubris. Stamina fertilia 2, filamentis gracilibus, liberis, albis. Ovarium ellipticum. Stylus gracilis, viridis. Capsula pollicaris, cylindrica acuminata, nigra.

Plentiful in Tahan Valley woods.

D. SALICINA, n. sp. Suffrutex pusilla, caule ligneo ramoso; inferne glabro, superne pubescente. Folia ad apicem congesta, plura anguste lanceolata, glabra, serrata, 3–4 pollices longa, $\frac{1}{2}$ pollicem lata vel paullo latiora, pallide viridia (sicca grisea), subtus rufescentia, costa et nervis subtus prominentibus, ascendentibus, in intramarginali conjunctis. Pedunculi plures in axillis congesti, gracillimi, glabri, rufi, 2-pollicares, foliis breviores, ramis superne divaricatis, gracilibus, brevibus, pubescentibus. Flores inter minimos, rosei, circiter $\frac{1}{8}$ pollicem longi. Sepala angustissima, linearia, pubescentia. Corolla brevis, campanulata, lobis ovatis acutis. Stamina fertilia 2, filamentis brevibus, gracilibus, rubris, antheris reniformibus, majusculis (pro flore), profunde excavatis. Stylus longus, corollam superans, crassiusculus, curvus, ruber, glaber. Stigma parvum, capitatum. Capsula rubra, glabra, gracilis, cylindrica acuminata, $\frac{3}{4}$-pollicaris, rostro tenui breviusculo.

Rocky places on the Tahan River.

D. HETEROPHYLLA, n. sp. Caulis brevis, radice longo lignoso repente, circiter pollicaris, lanuginosus. Folia congesta, forma et magnitudine valde diversa, obovata obtusa obliqua vel lanceolata crenulata, basi in petiolo brevi, $\frac{1}{4}$-pollicari, lanuginoso attenuato, 4 pollices longa, $1\frac{1}{2}$ pollices lata vel minora, superne glabra, obscure viridia, medio purpurascente, subtus rufescentia, nervis elevatis cum costa tomento rubiginoso tectis.

Pedunculi graciles, folia paullo superantes hispidi, circiter 3-pollicares, ramis brevibus, terminales. Flores parvi, violacei. Calycis sepala linearia, pubescentia, $\frac{1}{8}$-pollicaria. Corolla $\frac{1}{4}$-pollicaris, campanulata, lobis obtusis rotundatis pubescentibus. Stylus corollam superans, pubescens. Capsula pollicaris, cylindrica, crassiuscula, falcata, rostro longo.

Tahan woods. Very local; nearly out of flower.

This is an ally of what I take to be the *D. lanceolata*, C. B. Clarke, of Borneo; but it has very much shorter flowers, not tubular and dilated at the mouth, but bell-shaped.

DIDYMOCARPUS PYROLIFLORA, n. sp. Caulis 3-pollicaris vel ultra, lignosus, pubescens. Folia alterna, longe petiolata, ovata vel ovato-lanceolata, utrinque acuminata, 3–4-pollicaria, 1$\frac{1}{2}$ pollices lata, integra, læte virentia, superne sericeo-pubescentia, subtus pallidiora, petiolus ultra pollicaris. Pedunculi axillares, plures, erecti, validuli, 3–4-pollicares, breviter hispidi. Flores plures, breviter pedicellati, nutantes, $\frac{1}{4}$-pollicares, albi. Calyx 5-partitus, lobi lanceolati, breves, pubescentes. Corolla infundibuliformis, ventricosa, $\frac{3}{8}$-pollicaris, lobi breves, obtusi, rotundati, albi. Stamina 2; filamenta brevia et crassa, antheræ magnæ, ellipticæ, profunde canaliculatæ, flavæ. Stylus crassus, curvus, corolla longior, minute pubescens. Stigma minimum, capitatum. Capsula teres, rostrata, pollicaris.

Dry places in the woods, Tahan River.

A pretty little plant, its nodding white blossoms with the long protruded style reminding one of those of a *Pyrola*.

D. LILACINA, n. sp. Herba erecta, circiter 12–15-pollicaris, haud ramosa. Caulis undique foliatus, firmus nec ligneus, pubescentia brunnea tectus. Folia alterna, dissita, patentia, lanceolata, petiolata, herbacea, circiter 4 pollices longa, vix ultra pollicem lata, utrinque acuminata crenato-dentata, pubescentia, obscure viridia, nervis conspicuis. Pedicelli plures e petiolis prope laminam exorti, breves, $\frac{1}{4}$-pollicares, pubescentes. Sepala brevissima 5, hispida, lanceolata. Corolla campanulata, parce pubescens, lobi oblongi rotundati. Stamina 2, filamentis ad basin tenuibus, medio incrassatis; antheræ majusculæ, reniformes. Stylus corolla brevior, crassiusculus, pubescens. Stigma capitatum. Capsula $\frac{5}{8}$-pollicaris, crassiuscula, cylindrica, rostro brevi acuto.

Dry woods, Tahan Valley.

I do not know any species closely allied to this. It is a pretty little plant, though the lilac bells are small. The inflorescence seems to arise from the middle of the petiole, but in reality what appears to be the base of the petiole is a short branch from which the leaf also springs.

CYRTANDRA SUFFRUTICOSA, n. sp. Frutex magna ad 4-pedalis, caulibus pluribus quadrangulatis fistulosis, $\frac{1}{4}$ pollicem crassis. Folia opposita, lanceolata, abrupte acuminata, subobliqua, petiolata, marginibus integris, adulta glabra, circiter 10-nervia, pagina superiore obscura, inferiore rubescente (in sicca), 7 pollices longa, 2$\frac{1}{2}$ pollices lata, petiolis $\frac{3}{4}$

pollicem longis. Portiones juniores pubescentia rufa tectæ. Pedunculi breves et crassi, axillares. Bracteæ haud connatæ, ovatæ acutæ, pubescentes (siccæ rufescentes), pollicem longæ, ½ pollicem latæ. Flores circiter sex in capitulo ferme sessiles. Calyx deciduus, sepala 5 linearia. Corolla glabra, ultra-pollicaris, basi tubulosa, superne dilatata, circiter ½ pollicem longa, lobi rotundati obtusi, albi, striis brunneis in fauce. Stamina fertilia 2, filamenta crassiuscula; antheræ magnæ, ellipticæ, connatæ. Stylus elongatus, gracilis, pubescens. Capsula ¾-pollicaris, crassa, punctata.

Pulau Tiuman.

A large spreading bush, growing on a big rock over a mountain stream. This is most nearly allied to a plant which I believe to be *C. oblongifolia*, C. B. Clarke, a Bornean species; but it is very much larger in all its parts. The quite glabrous corolla is peculiar.

CYRTANDRA PILOSA, Blume.

Tahan woods, in damp spots, near Kwala Tenok.

Cup-shaped bracts white; flowers white, with a yellow and brown blotch in the throat.

STAURANTHERA UMBROSA, C. B. Clarke.

Damp stream-beds in the Tahan Valley; also found on Gunong Panti in Johore.

Flowers white, with a violet centre spot. Not hitherto met with in the Peninsula. A native of Assam.

EPITHEMA CARNOSUM, Benth.

On the limestone rocks of Kota Glanggi.

A typical limestone plant, occurring also at the Kwala Lumpur caves.

ISANTHERA PARVIFLORA, n. sp. Suffrutex erecta, rigida, pauciramosa, ad 3-pedalis, caulibus ligneis, basi nuda, superne foliata, lanugine rufescente tecta. Folia opposita, 8 pollices longa, 3½ pollices lata, lanceolata acuta, petiolata, basi cuneato-serrata, nervis 13, pagina superiore atro-viridi, ferme glabra, costa rubro-hirsuta, inferiore pallidiore tomento rubiginoso tecta, nervis et costa dense rufo-lanuginosis; petioli pollicares. Paniculæ plures breves, e basi nuda caulium exortæ, multo et laxe ramosæ, ramis et pedicellis rufo-lanuginosis. Flores perparvi, flavescenti-albi. Sepala ferme libera ad basin, 5 lineari-lanceolata acuta, 6 mm. longa, dense rufo-lanuginosa. Corolla vix longior, campanulata, lobis oblongis obtusis. Stamina 4, brevissim; antheræ ellipticæ quadratæ, apicibus dehiscentibus; filamenta brevia et crassa. Stylus ovario longior, gracilis. Stigma capitatum. Capsula ovoidea, globosa, pilosa, sepalis paullo brevior.

Dry woods at the mouth of the Tahan River.

Evidently an ally of the Indian *I. permollis*, Nees, but the corolla is very much shorter, the style longer, the stamens dehisce at the top, and the leaves are opposite. It is a shrubby plant, with several erect stems rising from the root, with few or no lateral branches.

ACANTHACEÆ.

THUNBERGIA FRAGRANS, Roxb.

Kalang Kasai, near Pekan.

I cannot say whether this was wild here, as it was brought in by the collectors. I have not seen it elsewhere wild in the Peninsula, but it is tolerably common in cultivation, and often occurs as an escape in Singapore. It is no more fragrant here than in Ceylon.

T. LAURIFOLIA, Lindl.

In woods and thickets. Pulau Manis; Kwala Tembeling.

EBERMAIERA GRIFFITHIANA, T. Anders

Damp spots in the Tahan woods. It also occurs in Singapore in the Fern valley at Bukit Timah.

E. LONGIFOLIA, Nees.

Tahan woods.

Common. Flowers white, with a maroon-pink stain in the mouth.

E. SETIGERA, Nees.

Prostrate plant. Damp spots in the woods at Kota Glanggi.

RUELLIA REPENS, Linn.

Tahan Valley.

HEMIGRAPHIS CONFINIS, T. Anders.

Very common by roadsides, and in dry spots along the Pahang River at Pekan, Renchong, and Mahang.

LEPIDAGATHIS LONGIFOLIA, Wight.

Woods at Kota Glanggi and Pulau Tawar.

Common through the dense jungles of the interior of the Peninsula at Selangor, Sungei Ujong, and Malacca. The flowers are dull lurid purple. I have never met with fruits, so its genus must still be doubtful.

ACANTHUS EBRACTEATUS, Vahl.

Kwala Pahang and up the river as far as Katapong.

This, the white-flowered species, is common in maritime mud, on the coast and up tidal rivers. The seeds pounded have a great reputation among the natives in cases of boils.

HYGROPHILA ANGUSTIFOLIA, Nees.

Ditches and pools, Pekan, also Kamposa in Kelantan.

H. SAXATILIS, n. sp. Herba parvula, 3–6-pollicaris, caulibus nodosis, subtetragonis, virgatis, erectis. Folia opposita, stricta, 3 pollices longa, ¼ pollicem lata, lanceolata acuta, sessilia, nervis reticulatis, atro-viridia. Flores sessiles bini, axillares, bracteis pluribus. Sepala 5, lanceolata, anguste acuminata, tubum corollæ æquantia, viridia, apicibus rufescentibus, scabrido-hispida. Corollæ tubus brevis, crassiusculus, superne dilatatus, bilabiatus, extus albescens, intus violaceus; labium superius late ovatum truncatum, apice bifido, violaceum; labium inferius late oblongum obovatum, basi pallida, apice trifido, lobis æqualibus linearibus truncatis, recurvo, violaceo, maculis brunneis pluribus ad basin. Stamina 4 inæqualia, 2 longa, 2 brevia; antheræ fuscæ, apicibus obtusis, loculorum basibus divergentibus, filamenta gracilia, curva, majore parte ad tubum corollæ adnata. Stylus gracillimus, apice recurvo, albus, basi rubescente. Stigma minutum, punctiforme. Capsula fusiformis, ¾ pollicem longa.

Common on rocks in the Tahan River.

A much smaller plant than *H. angustifolia*, and of quite a different habit.

ERANTHEMUM MALACCENSE, C. B. Clarke.

Thickets at Pekan. By no means so common here as in Sungei Ujong and Malacca. The corolla, described as pale purple by Mr. Clarke, is rather of a blue-violet colour.

E. ANDERSONI, Mast. (*E. Blumei*, Teysm.; Anders. Indian Acanthaceæ, in Journ. Linn. Soc. ix. 1867, p. 523.)

The description is based on a plant obtained in Singapore in 1861. I have never seen it wild here, and think it likely that Dr. Anderson got it from a garden. It is largely cultivated here now, and is easily propagated by cuttings, but does not appear to fruit. It is stated to be wild in Borneo.

JUSTICIA GENDARUSSA, Linn. f.

Common in gardens at Pekan, Kalambalai, Rumpin River, and also met with far up the Tahan River. It is often cultivated for medicine, under its Malay name of "Ganda Rusa."

It often remains long after other traces of former cultivation have disappeared, and then looks as if native. It never seems to fruit, however, and I doubt its being wild in any place in which I have seen it, including the Tahan Valley locality. Here, it is true, there was evidently never a village. The plant grew in a small patch on the river-bank, and not far off were some plants of the Keladi (*Colocasia antiquorum*, Schott), which also appeared at intervals along the river-banks and were also evidently not wild. I imagine from the appearance of the place that the Sakais had here pitched one of their temporary camps, and, having brought from the Malay villages some keladis to eat, dropped portions which developed into plants, and that probably at the same time they had some pieces of "Ganda Rusa," which also being left sprang up.

PERISTROPHE ACUMINATA, Nees.
Common in thickets. Pulau Tiuman, Pekan.

P. PALLIDA, Nees.
Pekan. Not recorded from the Peninsula in the 'Flora of British India.'
The flowers are of the same colour as those of *P. acuminata*, Nees, a dull pink.

VERBENACEÆ.

CALLICARPA ARBOREA, Roxb.
A fine tree with large masses of lilac flowers. Kwala Tembeling.

C. CANA, Linn.
A shrubby plant with the habit of *C. longifolia*, called "Tampa besih puteh." Tulomalaty, Pahang River, Kwala Berar.
It is common in waste ground in Malacca, Sungei Ujong, rarer in Singapore.

C. LONGIFOLIA, Lam.
Very common. Pekan, Kwala Luit, Kwala Berar.

C. LANATA, Linn.
Tanjong Antan, Pulau Chengei.

PREMNA SCANDENS, Roxb.
Renchong.

P. INTEGRIFOLIA, Linn. ?
This is the name that Dr. King gives to a small prostrate plant, more rarely a stunted bush, growing beneath the *Casuarinas* at Kwala Pahang. Like most other species, it is very aromatic.

GMELINA VILLOSA, Roxb.
Pekan, Temerloh, Kwala Pahang. A large bush, often very thorny.

(*G. hystrix*, Kurz, recorded, in the 'Flora of British India,' only from Tenasserim, Siam, and the Philippine Islands, I have recently met with apparently wild in Tanglin in Singapore.)

VITEX TRIFOLIA, Linn.

Called "Lagundi." Kwala Pahang, Mahang, Kwala Berar. I think it is native, at least in the last two localities.

——, var. OBOVATA. (*Vitex repens*, Blanco.)

Sea-shore, Kwala Pahang.

At first sight no two species could look more distinct than *V. repens* and typical *trifolia*, one a prostrate creeping plant in the sand, the other a tall erect bush; but plants of the former brought from Pahang speedily converted themselves under cultivation into large bushes of *V. trifolia*. *V. repens* is distinguished not only by its habit, but by its larger flowers and always simple leaves.

V. PUBESCENS, Vahl.

Very common all over the open country from Pekan to Kwala Tahan. It is known everywhere as "Alban."

V. SIMPLICIFOLIA, C. B. Clarke.

Ayer Hitam, near Pekan, in swampy grounds.

This curious tree, with yellowish-green flowers, seems to be the same as the plant described by Mr. Clarke from Griffith's Malacca specimens.

V. VESTITA, Wall.

Kota Glanggi woods. Not so common as in Singapore, where it is abundant.

CLERODENDRON INERME, Gærtn.

Kwala Pahang and Katapong, near Pekan.

Common on sea-shores, more rarely inland. Flowers white, with pink stamens. A fairly large bush.

C. DISPARIFOLIUM, Blume.

Not very common. Pulau Jellam, Kwala Lepar, Kwala Tembeling.

A small tree, with yellow flowers and black berries, and in fruit red calyx-lobes. This plant is very common in Singapore, less so in Malacca.

C. SERRATUM, Spreng.

Common at Pekan and on the river-banks at Kwala Tembeling. In thickets.

C. SIPHONANTHUS, R. Br.

Very glentiful in some of the meadows on the banks of the Pahang River at Mahang.

Apparently quite wild. The natives in Singapore smoke the dried leaves, which produce an intoxication similar to that caused by Indian Hemp.

PERONEMA CANESCENS, Jack.
Tahan River woods.
A big, rather handsome, shrub with white flowers.

SPHENODESMA BARBATA, Schau.
Bohie, Pekan. Called "Ahgalumoot."

S. PENTANDRA, Jack.
Common. Kwala Tembeling, Kwala Luit.
Flowers blue, known as "Lintang Ruas."

AVICENNIA ALBA, Blume.
Sea-shores, Kwala Pahang.

LABIATÆ.

OCIMUM BASILICUM, Linn.
Common at Pekan. Often cultivated.

DYSOPHYLLA AURICULARIA, Blume.
Pekan, Passir Loyang, &c.
Common in dry places. Usually called "Ekor Kuching" (Cat's Tail).

LEONURUS SIBIRICUS, Linn.
Common in Pekan. Evidently introduced.

LEUCAS ZEYLANICA, R. Br.
Common everywhere.

GOMPHOSTEMMA CRINITUM, Wall.
In shady woods, local, but often plentiful where it occurs. Kwala Tembeling, Kota Glanggi.
About three feet high, with conspicuous yellow flowers. The fruit is about as large as a buck-shot, succulent and white.

G. OBLONGUM, Wall.
Tahan River, Kota Glanggi woods.
Flowers white, much larger than the preceding. Named for me by Dr. Prain, from whom I gather that the flowers are usually yellow; but everywhere that I saw this plant it had pure white flowers.

HYPTIS SUAVEOLENS, Poit.
Common in open country near Kwala Pahang.

H. BREVIPES, Poit.
Common in damp spots in open country. Pahang and Tembeling Rivers.

Pogostemon Patchouly, Pellet.

A weedy herb with very small lavender-blue flowers. Tahan River, very far up, and a long way from cultivation, but with *Justicia Gendarussa* and *Colocasia antiquorum*. Also Pulau Tawar, abundant at one spot.

I certainly did not recognize this as the cultivated Patchouli, but Dr. Prain writes that he does not recognize the species, and suspects it to be the wild original form of Patchouli. He says it resembles *P. parviflorus*, Benth., and *P. Heyneanus*, Wight, but is distinct. I have what appears the same plant from Borneo and Selangor, under the name of Nilam or Chilam Bukit. Now "Nilam" is Malay for Patchouli. This latter plant has been long cultivated by the Malays for scent, but under cultivation produces no flowers. In the 'Flora of British India' a number of synonyms are given for Patchouli, and figures, viz. of *P. Heyneanum*, Wt., Icones, 1440, and Pelletier, in Mém. Soc. Sc. Orléans, v. (1845) 277, t. 7, are quoted as representing flowering plants of this; but it has for some time been very doubtful whether any of these are really the true Patchouli plant of the Straits, and it seems likely that the Tahan one is really the true plant. If so, a puzzling question has been set at rest, for I have not any doubt that it is really wild here, and that it is quite distinct from the other plants supposed to be the wild parent form.

APETALÆ.

AMARANTACEÆ.

Celosia argentea, Linn.

An escape from cultivation, Kwala Tembeling; on an island in the river at Kelantan.

Allmania nodiflora, R. Br.

Sandy spots beneath Casuarinas at Sungei Meang.

Amaranthus spinosus, Linn.

A common weed in waste places. Pekan, &c.

A. viridis, Linn.

Very common in waste ground. Pekan, &c.

The Amaranti are called "Bayam" by the Malays, who use them for spinach, the best of which is *A. spinosus*, Linn.

Cyathula prostrata, Blume.

Sea-shore, Pulau Tiuman. Common.

Achyranthes aspera, Linn.

Sandy places near the shore, Sungei Meang, &c.

ALTERNANTHERA SESSILIS, R. Br.

Very common both on the sea-shores and inland, in dry places. Pekan, Ayer Hitam. Also collected at Kamposa in Kelantan.

POLYGONACEÆ.

POLYGONUM PEDUNCULARE, Wall.

In a damp spot on the Sungei Parit, at Pekan. Flowers pink.

P. FLACCIDUM, Meissn.

Common in damp spots on the Pahang River. Renchong; Pulau Manis; a glabrous form at Pulau Rumput.

P. MICRANTHUM, Meissn.

Common in damp spots, Katapong, near Pekan, Tanjong Antan, Pulau Tawar, Temerloh.

NEPENTHACEÆ.

NEPENTHES AMPULLARIA, Jack.

Kuantan.

This species, though very common in the south of the Peninsula and especially in Singapore, becomes less frequent further north. It is described in the 'Flora of British India' as "prostrate, with a whorl of many short pitchers, above erect." It is in the wild state far-climbing, making long stems, surrounded at intervals with clusters of pitchers. The pitchers are light green, sometimes plain, but oftener spotted with purple. This colouring depends on the amount of light the pitchers obtain; those half concealed among dead leaves, &c., are usually unspotted. I once met with a very fine variety with very large ivory-white pitchers. It was growing in deep grass, so that the pitchers were really blanched for want of light.

N. RAFFLESIANA, Jack.

Fairly common near Pekan, at Jambo, and also received from Kuantan.

N. REINWARDTIANA, Miq.

The commonest species in Singapore, common round Pekan. This plant prefers hot grassy places.

N. GRACILIS, Korth., var. ARENARIA.

A compact tufted form, not scandent, with numerous small pitchers crowded together, almost imbedded in the sand. Pramau, Pekan, in dry sandy heaths.

After leaving Pekan and the district immediately surrounding it, the Pitcher-plants disappeared, nor were any met with on the upper parts of the River Pahang, nor at Tembeling, nor in the Tahan district.

ARISTOLOCHIACEÆ.

BRAGANTIA TOMENTOSA, Blume.

A remarkable little plant with small purple flowers hidden in the soil. Kwala Tembeling woods.

This has not hitherto been recorded from the Malay Peninsula. Mr. Curtis got what is evidently the same plant at Tanjong Sirih in Kedah and in the Lankawi Islands.

THOTTEA, sp.

I saw in several places what I believe to be the leaves of *T. grandiflora*, Rottb., but could find neither fruit nor flowers.

ARISTOLOCHIA ROXBURGHIANA, Klotzsch.

Twining on old stumps and in bushes on islands in the Pahang River. Flowers with a green globose base, then abruptly bent; tube green, lip pubescent hairy, deep brown, with a white blotch at entrance to tube. Leaves deep green, shining.

PIPERACEÆ.

PIPER CANINUM, Blume.

A scandent plant climbing through the bushes; berries scarlet. Woods, Tahan River.

P. MURICATUM, Blume.

An erect herb, one form very hirsute, another with the lower part of the stem glabrous. Kota Glanggi woods.

P. CHABA, Hunter.

Common in Pekan. Usually found in waste grounds in the villages. It is used medicinally under the name of "Chabei."

It most commonly occurs as an erect herb about a foot high, with deep green leaves and white flower-spikes, but eventually emits runners, and sometimes becomes scandent.

P. BETEL, Linn.

Commonly cultivated for chewing with Areca-nut.

P. ROSTRATUM, Roxb.

Kota Glanggi woods.

The form here had fiddle-shaped leaves; the commoner form in the Peninsula appears to be one with more oblong-ovate leaves.

P. LONCHITES, Roem. & Schult.

Kwala Tahan, near the first camp, climbing up and thickly covering the stem of a tree.

P. ARGYROPHYLLUM, Miq.

Woods, Kota Glanggi.

This Pepper is common in the woods, especially of the limestone districts, and is very conspicuous on account of its ornamental leaves marbled with white; but it is very rarely met with in flower.

PIPER PORPHYROPHYLLUM, N. E. Br.

Tahan woods.

P. SUBPELTATUM, Willd.

Woods, Kwala Tembeling. This fine shrubby Pepper also occurs in great plenty at the limestone caves of Kwala Lumpur.

PEPEROMIA PORTULACOIDES, A. Dietr.

Fairly plentiful upon the limestone rocks at Kota Glanggi. A succulent plant with reddish leaves and stems, not previously recorded from the Malay Peninsula, but evidently identical with the plant figured by Wight, Icones, 1922, from Southern India.

CHLORANTHUS OFFICINALIS, Blume.

Woods, Pulau Tawar, Kwala Tembeling; rather common.

MYRISTICACEÆ.

MYRISTICA IRYA, Gaertn.

Big tree, in open country. Mahang.

M. MISSIONIS, Heyne.

A small tree, common. Kwala Pahang, Pulau Manis.

M. PURPURACEA, Hook. f.

A tree of no great size. Woods, River Tahan, Pulau Chengei.

M. HOOKERIANA, Wall.

I saw a number of trees of what I believe were this species in several places, but collected no specimens, as they were not in flower or fruit.

Fruits of several other wild Nutmegs were lying on the ground in different parts of the Tahan woods.

LAURINEÆ.

CINNAMOMUM INERS, Reinw.

A small tree, rather bushy, common in open country and secondary jungle. Pekan.

(*C. javanicum*, Blume, is inserted in the 'Flora of British India' on the evidence of a specimen from "Singapore at Madang, N. Cantley." Mr. Cantley's specimen was probably out of the Botanic Gardens, "Madang" being intended for "Medang," the Malay word for any Laurineous plant.)

PHŒBE LANCEOLATA, Nees.

A small tree or large bush, on the banks of the Tahan River; plentiful. This is a new record for the Peninsula. It appears to be common in India as far south as Tenasserim.

ACTINODAPHNE, sp.

Small tree with large leaves and flowers on the stems. Tahan woods. "Medang Kunyit" of the Malays.

LITSEA AMARA, Blume.

Small tree, yellow flowers. Tulomalaty, Kwala Luit.

L. POLYANTHA, Juss., var.?

Pulau Tawar, open country. Flowers yellow; leaves smaller than usual. This is possibly a distinct species.

L. ZEYLANICA, C. & F. Nees.

Common on the heath country. Pramau, Kwala Pahang. Usually a large bush. It is also plentiful in some spots at Changi in Singapore, and in Malacca.

MICROPORA CURTISII, Hook.

Kwala Triang, Lubu Lanjoot, on the Pahang River.

CASSYTHA FILIFORMIS, Linn.

Common in the open sandy country near the sea. Pramau, Pekan, Rumpin River.

THYMELEACEÆ.

WIKSTRŒMIA CANDOLLEI, Hook.

Open heathy country. Pramau, near Pekan, to the mouth of the river; also on Pulau Tiuman, and at Kamposa in Kelantan.

A small tough shrub with yellow flowers and red berries.

AQUILARIA MALACCENSIS, Lam. (Gaharu-wood.)

This highly-prized incense-wood is collected in the woods of the Tahan River by the Sakais, who sell it to the Malays. Good Gaharu-wood is very expensive, and imitations of it are made, by scenting other decayed woods, by the Malays, who sell it to the Chinese.

Only certain trees contain the scented heart-wood, and these are known by the gnarled appearance of the exterior.

Gaharu-wood is often confounded with Lign Aloes, or Eagle-wood, supposed to have been imported by King Solomon for the Temple. This is, however, the product of *A. Agallocha*, Roxb., which is not a native of the Malay Peninsula, so far as I am aware. Avicenna clearly distinguished two products, as Garcia ('Historia Aromatum,' i. p. 65) points out, under the names of Xylaloes and Agalugen. It is probable that the former of these, however, was Sandal-wood. Garcia himself does not distinguish the Indian and Malayan kinds, though he gives the native names of each kind: "Dicitur Arabibus Agalugen et Haud, Guzerate et Decan incolis Ud, . . . in Malaca Garro, selectissimum autem Calambac."

LORANTHACEÆ.

LORANTHUS LOBBII, Hook. f.

I obtained what I believe to be this species in the Tahan woods, but it was only in young fruit, so that I cannot be quite certain.

LORANTHUS PENTAPETALUS, Roxb.
Pekan, Kwala Pahang.

L. HETERANTHUS, Wall.
Not rare round Pekan and at Kwala Pahang. Flowers red.

L. FERRUGINEUS, Roxb.
Common at Katapong, near Pekan.

A most noxious plant in Singapore, growing with great rapidity on the trees and killing them. It seems to grow on almost any tree. I have seen it on *Litsea lancifolia*, *Tectona grandis*, *Artocarpus* spp., *Eugenia macrocarpa*, *Canarium rufum*, *Mappa javanica*, *Baccaurea Motleyana*, *Aporosa nigricans*, and *Codiæum variegatum*.

L. MALACCENSIS, Hook. f.
At Pramau and Katapong.
Flowers brown. Not at all a common plant.

L. PENTANDRUS, Linn.
Sungei Meang, on *Paritium tiliaceum*. Common.

L. RETUSUS, Jack.
Parasitic on bushes. At Pekan; also at Tringganu.

This is a very pretty plant with pink flowers, the free part of the petals bright green, tipped with dark pink. The fruit is red, becoming black. I have met with it also in Singapore, at Changi, and at Pulau Tekong. It is commonly parasitic on *Rhodomyrtus tomentosa*, and has a curious habit of emitting branches which, running parallel to those of its host, put out haustoria just as *L. ampullaceus* does.

L. FORMOSUS, Blume.
Tahan River.
Flowers crimson-scarlet.

L. FORBESII, King.
Not rare in the Tahan woods; usually on high trees.

The curious four-angled involucre of bracts enclosing a number of flowers distinguishes this striking plant from any others of the native species. Bracts and flowers are scarlet.

L. (§ MACROSOLEN) CASUARINÆ, n. sp. Caules validi, lignosi, juvenes tomento aurantiaco tecti. Folia opposita, ovato-lanceolata acuminata subacuta, carnosa, superne glabra, subtus tomento ferrugineo tecta, costa utroque latere crassa, nervis lateralibus ascendentibus, lamina 5 pollices longa, 2 pollices lata, petiolo $\frac{1}{4}$-pollicari. Racemi pollicares, axillares, lanugine ferruginea tecti, pluriflori. Flores magni, sessiles, nutantes. Bracteæ lanceolatæ acuminatæ. Corolla $1\frac{3}{4}$-pollicaris, versus basin angustata, superne dilatata, curva, quinquefida, lobis linearibus curvis ferme $\frac{1}{2}$-pollicaribus, tubo ultra dimidium uno latere fisso, extus omnino lanugine aurantiaca (sicca ferruginea) tecta, intus glabra. Stamina 5, laciniis subæquilonga, antheris terminalibus linearibus acutis. Stylus longior, stigmate subclavato. Bacca lageniformis, lanugine ferruginea tecta, ⅜-pollicaris (vix matura).

Plentiful on *Casuarina equisetifolia*, Forst., at Sungei Meang.

This *Loranthus*, though common here, I have not seen elsewhere. I am unable to match it with any described species. When alive, the whole plant is orange-coloured, due chiefly to its orange wool covering the backs of the leaves, shoots, and flowers. When dried it is ferruginous.

LORANTHUS AMPULLACEUS, Roxb.

Kalambalai, near Pekan; also on Pulau Kattam, in Tringganu River. On *Anacardium occidentale*, Linn.

This is nearly as injurious a plant as *L. ferrugineus*, but not quite so common. It is parasitic on a great number of trees, among which I have noticed *Morinda citrifolia*, *Anacardium occidentale*, and a species of *Eugenia*.

L. GRANDIFRONS, King.

Tulomalaty; Kwala Berar; Kwala Tembeling.

A very handsome species, with large pink flowers, tipped with green. It is parasitic on *Vitex vestita*, &c.

VISCUM ARTICULATUM, Burm. f.

Pekan.

A common plant, parasitic on *Loranthi*, especially *L. ampullaceus*, Roxb. The common form is *V. articulatum*, var. *genuinum*—the form with narrow flattened branches. The internodes are flattened alternately, *i. e.* the one flattened in one plane is followed by the next at right angles to it. The flowers are often in pairs only at the nodes, in a line with the flattened axis below them. Male flowers yellow. Berries yellowish, transparent, smooth, shiny. Stem often erect.

V. ORIENTALE, Willd.

Less common. At Pulau Jellam. Usually parasitic on species of *Ficus*.

SANTALACEÆ.

HENSLOWIA LOBBIANA, DC.

Common on the heath country at Pramau.

This can be best described as a scandent bush. Growing at first erect among thickets, it throws out long branches, which partly scramble over those of the other bushes and partly twine round them. It has yellow berries, turning first red, then black. It is very common in Malacca.

HENSLOWIA BUXIFOLIA, Blume.

Woods at Pramau, near Pekan.

A very odd-looking plant, probably parasitic on roots of trees, with yellow stems. At first erect, eventually often twining, often leafless. The leaves, which are not described in the 'Flora of British India,' are obovate, spathulate, and yellow, like the stem; one inch in length, with a petiole $\frac{1}{4}$ inch long, with 3 or 5 veins visible when dry.

CHAMPEREIA GRIFFITHIANA, Planch.

Dry woods and thickets. At Pramau, near Pekan.

A straggling, erect shrub, with inconspicuous green flowers and sweet eatable orange drupes.

EUPHORBIACEÆ.

EUPHORBIA PILULIFERA, Linn.

A common weed. Pekan, Kwala Pahang, Pulau Jellam, &c.

E. THYMIFOLIA, Burm. f.

Common in waste ground and dry sandy places. Pekan, &c.; also at Tringganu.

E. ATOTO, Forst.

Common on the sea-shores in dry or rocky places. Sungei Meang; Rumpin River.

BRIDELIA STIPULARIS, Blume.

A big bush. Pulau Rumput; Pahang River.

AGYNEIA BACCIFORMIS, Juss.

Common among grass on the sea-shores at Sungei Meang and Kwala Pahang. I have also collected this plant at Changi in Singapore. It has not hitherto been recorded from the Peninsula.

PHYLLANTHUS FRONDOSUS, Wall.

Passir Loyang; River Tahan woods.

P. SIMPLEX, Retz.

A twiggy, erect plant, branching a little at the base, in grassy plains at Pulau Tawar.

The capsule in this plant is smooth; the seeds, which are certainly more than $\frac{1}{24}$ inch long, are very obscurely dotted, hardly tubercled.

P. NIRURI, Linn.

A common weed. Kwala Berar, &c.

PHYLLANTHUS PULCHER, Wall. (*Reidia glaucescens*, Miq.)

Very common along river-banks from Pekan to the Tahan River. It is evidently a native here, but I am less certain about Singapore. I have never seen it there except where it may be an escape from cultivation.

P. MADERASPATENSIS, Linn.

Sea-shore at Kwala Pahang. Not met with elsewhere.

P. CHAMÆPEUCE, n. sp. Frutex parva, 8-pollicaris, ramosa lignosa, ramis strictis. Folia copiosa disticha, oblonga, sessilia, minima, $\frac{1}{4}$ pollicem longa, mucronata, nervis conspicue elevatis, marginibus pubescentibus. Flores minimi, breviter pedicellati. Bracteæ lineares acuminatæ, ferme $\frac{1}{8}$-pollicares, flores multo superantes persistentes. Flores masculi sepalis 6 obovatis obtusis tenuibus, linea mediana obscuriore crassiore. Stamina 3, ferme omnino libera, filamentis brevissimis, antheris ellipticis longitudinaliter dehiscentibus. Flores feminei sepalis iis masculi similibus; pistillum subglobosum; stigmata 3, lobata sessilia in apice pistilli; styli nulli. Capsula globosa, parva, tricocca. Semina 3, trigona, brunnea, dorso transversim rugoso.

On rocks in the Tahan River, abundant in some places.

A very curious little stiff bushy shrub, like some very small conifer in appearance.

GLOCHIDION LITTORALE, Blume.

Pekan, Kwala Triang.

G. INSULARE, Hook. f.

Kwala Triang, Pramau.

G. SERICEUM, Hook. f.

Pulau Tawar.

G. OBSCURUM, Blume.

Small spreading bush. Pekan, Khol, Tembeling River.

FLUGGEA MICROCARPA, Blume.

A small bush with little white fleshy fruits. Pulau Chengei; banks of River Tahan.

BREYNIA CORONATA, Hook. f.

A pretty bush, covered with its red berries, on the sea-shores; common. Kwala Pahang.

SAUROPUS ALBICANS, Blume.

Common in and round the villages and in open country. Pekan, Mahang, &c.

This is the Chekop Manis of the Malays; an excellent vegetable, much cultivated in Singapore, but eaten only by natives. It is a small shrubby plant, with dull green leaves, which have often a whitish blotch in the centre. Flowers dull red; fruit rather large, pendulous, white or rosy, with the persistent red sepals at base. Seeds black.

Cleistanthus hirsutulus, Hook.

Kwala Tenok, Tahan River.

C., sp.

A small bushy tree with very white bark and numerous small ovate acuminate leaves, dark green above, paler beneath, glabrous. Capsule smooth black, three-lobed.

On the top of the limestone rocks, Kota Glanggi. A pretty little tree, of which I could find no flowers.

Actephila javanica, Miq.

A small tree with orange and pink flowers. The leaves decidedly dentate, as I have seen in other specimens. Capsule large, pendulous.

Common in dense jungle, Kwala Tembeling.

Choriophyllum malayanum, Benth.

A large bush, common on the heath country of Pramau, Pekan.

Aporosa microcalyx, Hassk.

A small tree. Renchong, Kwala Tembeling, Pulau Manis.

A. nigricans, Hook. f.

A large bush or small tree, with orange-yellow fruits. Woods, Pulau Tawar.

A. Praineana, King.

At Kwala Tenok, on the River Tahan. A small tree with yellow fruits.

A. stellifera, Hook. f.

A small tree with leaves as big as those of *A. ficifolia*, Hook., rough to the touch, but not hairy. The fruit is an inch long or more, oblong ellipsoid, orange colour, with the seeds enclosed in a pink pulp. It splits in four from the base. Kwala Tahan.

I believe this is the *A. stellifera*, Hook. f., of which I have hitherto seen only flowering specimens (indeed, the fruit has never been described); the foliage agrees well with that of plants identified with this species by Dr. King.

A. Benthamiana, Hook. f.

What is doubtless this species was common in the Tahan woods, as it is in Singapore, but it was not in flower. The peculiar stipules make it easily identifiable. It is rare to find it with flower or fruit.

A. aurea, Hook. f.

A small tree. Pigang, Pahang River. Common in Malacca.

A. Maingayii, Hook. f.

In woods, Pulau Tawar and Kota Glanggi.

A. ficifolia, Baill.

Bukit Duri, Pahang River (*W. Fox*).

ANTIDESMA ALATUM, Hook. f.

A small tree, common in jungles in many parts of the Peninsula. Pulau Tawar woods. It is called "Sakellet" in Pahang.

A. LEUCOCLADON, Hook. f.

Pulau Manis.

A. SALICIFOLIA, Miq.

A small, much-branched tree, with pendulous branches. Common on rocks and banks overhanging the rivers Tahan, Tembeling, and Pahang.

This plant differs from that described by Miquel in having the fruit ovate-oblong, and not "subobliquely ovoid," and in this agrees with a plant from the Plus River in Perak, described in the 'Flora of British India' under the name of *A. salicifolia*, Miq.? But that plant, which I have not seen, is said to have perfectly glabrous midribs and petioles, whereas those in the Pahang plant are pubescent. Neither Miquel nor Sir Joseph Hooker saw the flowers, so that I will describe the Pahang plant entirely:—

Arbor parva multi-ramosa, ramis pendulis, juvenibus pubescentibus, obscure quadrangularibus. Folia lanceolata acuminata, circiter 4 pollices longa, ¾ pollicem lata, glabra, costa utriusque paginæ pubescente, petiolis brevibus, basi incrassatis, pubescentibus, stipulæ lanceolatæ acuminatæ, pubescentes. Racemi singuli aut bini ad apices ramorum terminales. Masculi breves, circiter ¾-pollicares, breviter pedunculati. Flores minimi, congesti, pedicellis brevissimis, crassis. Bracteæ ovatæ. Calyx poculiformis, lobis 4 brevibus ovatis. Stamina 4, filamentis brevibus, crassis, loculis antheræ rotundatis, basi divergentibus, connectivo ferme reniformi, incrassato. Pistilli rudimentum processus parvus ellipticus. Racemi feminei 2-pollicares vel ultra. Flores copiosi, congesti, pedicellis quam in masculo longioribus. Bracteæ lanceolatæ acuminatæ acutæ, pedicellis æquales. Sepala 4, ovata acuta. Pistillum ampullaceum, stigmatibus brevibus recurvis acutis 4. Drupa parva, viridis, lævis, ovata oblonga, vix ultra ⅛ pollicem longa.

The fruit is said by the natives to be black when ripe and then eatable.

A. LONGIPES, Hook.

A small tree with pink fruit. Tahan woods.

A. VELUTINOSUM, Blume.

A shrub, not rare, with soft pubescent leaves and pink fruits. Pulau Chengei, Kwala Tahan. It is called here "Guché Gajah."

A. GHÆSEMBILLA, Gærtn.

Usually a small stunted bush, in open country. Renchong, common. Also collected at Kamposa in Kelantan.

A. CUSPIDATUM, Muell. Arg.

Tahan River woods.

ANTIDESMA MORITZII, Muell. Arg.

With male flowers only, but I believe rightly identified. Pekan.

BACCAUREA BRACTEATA, Muell. Arg.

A small tree, with red fruits and yellow seeds; rather common. Pekan.

B. BREVIPES, Hook. f.

A small tree, with white fruits and blue seeds.

Tahan woods and Kwala Tembeling. Called "Rambai Antan."

B. MALAYANA, King. (*Hedycarpus malayanus*, Jack.)

The "Tampoi." One tree loaded with fruit was seen in the Pulau Tawar woods apparently wild, but it was impossible to get specimens, as it was defended by a large nest of black hornets. The fruit is very well known in Singapore; it much resembles the Langsat in taste.

B. LANCEOLATA, Muell. Arg.

Pulau Chengei.

Flowers white; called "Poko Bidara." "Bidara" is, however, a name given commonly to any tree bearing fruits suggestive of plums, *e. g.* "Bidara-laut" (*Ximenia americana*).

B. MOTLEYANA, Muell. Arg.

From the descriptions of Mueller in De Candolle's 'Prodromus,' xv. ii. p. 461, and Hooker in the 'Flora of British India,' vol. v. p. 371, this appears to be the correct name of the well-known "Rambai." It seems distinct from Jack's *Pierardia dulcis*, which is a native of Sumatra, where it is known as "Choopa." I do not know this plant, however, but it is evidently allied to *B. Motleyana*. Common as this plant is in the Straits, it is remarkable that no complete description of it has ever been published. I therefore take this opportunity to describe it.

The "Rambai" is a compact tree about forty feet in height, the head usually being cone-shaped, though when a number of trees grow together the stems seem to be more drawn up and strict. The bark is light-coloured, and flakes off readily. The wood is white and moderately hard.

Leaves elliptic ovate, acute; base rounded, bilobed, hardly coriaceous, deep green above, hardly shining, glabrous; beneath paler, covered with thin brown pubescence; veins distinctly raised, with distinct reticulations 9 inches long, 5 inches across, or less. Petiole terete, not grooved, stout, 2 to 3 inches long, thickened at the base, joining the blade within its circumfererence, covered with a brown pubescence easily rubbed off.

Where the leaves fall off an ovoid scar is left on the branch. The trees are bi-sexual, normally, but female flowers are often to be seen on the spikes of male flowers, on a male tree; they are always at the base of the raceme.

Male flowers, sweetly scented, in depauperated panicles or racemes, about 9 inches long, pendulous from the old wood, on the branches, and more rarely on the trunk of the tree. The lateral branches of the panicle are very short when present. Rhachis light green, terete, pubescent. Bracts lanceolate acuminate, closely appressed to the peduncles, ⅛ inch long, pubescent. Peduncles flattened, ending in three or fewer pedicelled flowers. Bracteoles minute, lanceolate-acuminate. Perianth of 4 or 5 unequal lobes, ovate obtuse, connivent, lemon-yellow, pubescent outside, mealy inside. Stamens 5 to 7, very small, glabrous; filaments short, translucent, flattened, broadest at base, tapering upwards. Anther-cells separate, oval. Rudimentary ovary longer than the stamens, pillar-shaped, enlarged at the tip and capped, very pubescent with white hairs.

Female inflorescence racemose; rhachis much thicker than in male inflorescence. Flowers very much larger, ¼ inch across; pedicels short and thick, terete, pubescent, ⅛ inch long. Perianth-lobes connivent, very unequal, 5 to 8, light green, fleshy ovate. or ovate-lanceolate, blunt. Rudiments of stamens absent. Ovary globose, minutely pubescent. Stigmas sessile, thick, fleshy, recurved, papillose, white, 5 to 8.

Fruit oval elliptic, more than an inch long, and ¾ of an inch thick, rounded at both ends, terminated by the very small stigmas, and with the perianth persisting at the base, finely pubescent, with a thin buff skin, three-celled, three-seeded. Seeds enclosed in a translucent, whitish, sweet pulp, fixed by the apex, convex on one side, and flattened on the other.

The fruit is very popular with the natives. It is very sweet and refreshing, having somewhat the flavour of grapes. It is greedily devoured by monkeys, civets, and bats.

I have never seen the Rambai indisputably wild. It is often cultivated, and persists long after other signs of cultivation have disappeared, so as to appear really wild. I think, however, it will prove to be a native.

BACCAUREA PARVIFLORA, Muell. Arg.

Common in the Tahan woods.

This is called by the Malays "Setambon."

It is a small straight tree, with hard yellow wood, used for walking-sticks. The leaves are dark green; when young, pink. The male flowers, produced in spikes upon the old wood, are pale yellow and scented like cowslips. The females at the base of the stem, so plentifully that when in fruit there is quite a large pile of fruits round the base resting on the ground. The fruits are fusiform, deep claret-colour, nearly black outside when ripe, and quite eatable, though rather sour.

The tree is very common all through the Peninsula.

B., sp.

Evidently an ally of *B. parviflora*, Muell. Arg., resembling it much in the foliage; but the female inflorescence was scattered about on the stem, not piled up at the base; and the fruits are larger, light pink, and curiously reticulated. Seeds with dark pink aril.

Common, Kwala Tembeling woods. I could not get any flowers nor perfectly ripe fruits.

Mallotus floribundus, Muell. Arg.

A small tree. Pekan; banks of the river.

M. Griffithianus, Hook. f.

A small tree, with very curious capsules covered with bristly hispid spines.

Tahan woods, dense jungle.

M., sp.

Resembles the last, but has the leaves long-acuminate, with long petioles, and the fruit sessile and solitary. Tanjong Antan.

M. tiliæfolius, Muell. Arg.

An erect branched bush about ten feet high, growing in quantity in open country near the Sultan's tombs in Kwala Pahang. This has not hitherto been recorded from the Peninsula. It is a native of the Pacific islands, Timor, Java, Moluccas, and China.

M. macrostachyus, Muell. Arg.

Tulomalaty, Pahang River.

M. cochinchinensis, Lour.

Kalambalai, Pahang River.

Macaranga denticulata, Muell. Arg.

River Pahan; Pulau Chengei.

M. hypoleuca, Muell. Arg.

Is plentiful in the Medang woods near Pekan. This tree is very common in Singapore. Ghosts are supposed by the Malays always to sit under it at night, to which theory the ghostly white of its stems probably has given rise.

Sticks of the wood of this tree are preferred for setting gambir, after the liquid is poured into the buckets from the boiling-pan.

M. megalophylla, Muell. Arg.

Woods at Kwala Tahan.

M. Griffithiana, Muell. Arg.

Near Pekan.

M. Tanarius, Muell. Arg.

Pulau Datoh, Pulau Paday, Pahang River.

Jatropha Curcas, Linn.

Is cultivated here and there near Pekan, and in the villages a little way up the river.

Croton argyratus, Blume.

Woods, Pulau Tawar; Pulau Chengei.

C., sp.

A small tree on the limestone rocks of Kota Glanggi. I have also received this plant from the Lankawi Islands, and from Bangtaphan in Siam, and Dr. King sends it from Perak under the name of *C. argyratus*, from which it differs in the larger, more lepidote leaves, without glandulæ, much shorter flower-spikes, and very much smaller capsules.

CROTON CAUDATUS, Geisel. var. MALACCANA.

A scandent shrub or very large climber. A plant in the Botanic Gardens has a stem 4 inches thick, and climbs very high on a big tree. The fruit is globose and pubescent, of an orange colour. It is very common in Singapore and Malacca; also in Pahang at Pekan, at Tulomalaty and on the banks of the Tahan River, and at Kamposa in Kelantan. It is called "Tuku Tokol."

CLAOXYLON INDICUM, Hassk.

At Temerloh. It is called "Jarah Kayu" (*lit.* Tree Physic-nut).

ACALYPHA FALLAX, Muell. Arg.

A weed at Pekan.

A. FRUTICOSA, Forsk.

A low stunted bush in open dry places, at Pekan and Kwala Berar.

This differs from the form described in the 'Flora of British India' in having plumose styles and possessing no glands on the leaves. It is also nearly glabrous.

ERISMANTHUS OBLIQUUS, Wall.

Tanjong Antan.

HOMONOIA RIPARIA, Lour.

A very abundant bush on the rocky and sandy islets all up the Rivers Tembeling and Tahan. New to the Malay Peninsula.

CNESMONE JAVANICA, Blume.

In the waste ground in old orchards near Pekan, Kwala Tembeling. Also brought by Professor Vaughan-Stevens from Kemaman. This stinging climber is used, according to him, in the preparation of the Ipoh (arrow-poison). It is called "Jelatang."

HOMALANTHUS POPULIFOLIUS, R. Grah.

Very common in Kwala Berar, in Tulomalaty, Passir Loyang, and other spots on the Pahang River, in open country. It is here called "Mahang Makan Pelandok" (*i. e.* the Macaranga which the Mouse-deer eats).

SAPIUM BACCATUM, Roxb.

Common on the river-banks at and near Pekan. It does not seem ever to go far from tidal waters, and the curious fruits are often found floating in the sea. It is called "Guring" by the Malays. Usually a small tree with pendulous branches.

Sebastiana Chamælea, Muell. Arg.

Common in grassy spots on the sea-shore. Kwala Pahang, Cherating, Rumpin River; also inland at Pulau Tawar.

URTICACEÆ.

Trema amboinensis, Blume.

Banks of Tahan River.

I do not quite understand the difference between *T. amboinensis* and *T. orientalis*, Blume. Specimens labelled with the names of these two species received from Calcutta seem to me quite similar, except that one is a little more silvery than the other. *T. amboinensis*, like the other species here, is more usually a shrub than a tree, as it is described in the 'Flora of British India,' but I have seen it 12 or 15 feet high.

Gironniera parvifolia, Planch.

A small tree in the Tahan woods.

This is the only species one meets with in the denser and older jungles. *G. nervosa*, Planch., and *G. subæqualis*, Planch., are more characteristic of open low country woods.

Phyllochlamys Wallichii, King.

Pulau Chengei.

I understand this plant to be distinguished from *P. spinosa*, Bur., by its leaves being entire, or very nearly so; but as to form, they vary very much. In the Pahang plant they are lanceolate or ovate-lanceolate, acute, often oblique, short or moderately long-petioled, drying pale or dark, the larger, less coriaceous, dark-drying leaves being often slightly denticulate. Curtis's specimens from Penang have the leaves narrow, lanceolate, blunt, and emarginate. The Pahang specimens have the imbricating bracts alluded to in the 'Flora of British India.'

Sloetia Sideroxylon, Teysm.

Common in the Tahan woods.

This gives the excellent timber known as "Tampenis."

Ficus pisifera, Wall., var.

Temerloh. The figs are green, with white spots. Dr. King says, "Leaves too hairy for typical *F. pisifera*."

F. quercifolia, Roxb., var. **humilis**.

Pulau Tijau.

F. globosa, Blume.

At Pekan.

F. consociata, Blume.

Temerloh. The terminal buds in this specimen were converted into large white conical galls.

F. truncata, King.

A small tree. Open country at Pramau, Pekan.

FICUS PISOCARPA, Blume.

A small tree with white figs. Woods at Kota Glanggi.

F. GLABELLA, Blume.

A big tree on the river-bank, Pekan, also at Kwala Tembeling. Figs green with white spots.

F. AURANTIACA, Griff.

One of the handsomest of the *Synœcia* section with large globose or nearly globose orange-red figs, ornamented with paler spots. Pekan, climbing on trees.

F. HETEROPHYLLA, Linn. f.

A climbing shrubby plant in thickets. Pulau Datoh, Pahang River. Figs green.

F. POMIFERA, Wall.

A high tree with very large pink figs with white spots. Kwala Tembeling.

F. MIQUELII, King.

Khol, Tembeling River, and at Pekan.

F. PYRIFORMIS, Hook. & Arn.

A very curious little shrub, creeping in moss on rocks overhanging the river; rare. Leaves narrowly lanceolate; fruit spotted with pink.

F. PROCERA, Blume.

Kwala Berar.

F. INDICA, Linn.

A big tree on Pulau Tiuman.

F. CUNEA, Ham.

Pulau Tawar. In thickets on the river-bank.

A small tree with red figs with white spots, borne on branches running along the ground. The figs are sweet and good to eat. Not hitherto recorded from the Malay Peninsula. A native of Borneo.

F. HISPIDA, Linn.

Common tree, with green figs. Pekan, Mahang, Pulau Tawar; also Kamposa in Kelantan, open country.

F. FISTULOSA, Reinw.

Kwala Tembeling. A common tree.

F. DIVERSIFOLIA, Blume, var. OVOIDEA.

This I believe to be the common epiphytic and also terrestrial form with small obovate leaves, often very yellow at the back, and bearing small yellow fruits. Common in Pahang, especially in the open country at Pramau. It is usually epiphytic, and is very plentiful on the trees in the mangrove-swamps in Singapore. In sandy country it grows in the form of a small compact bush on the ground, as at Changi, in Singapore.

Ficus diversifolia, var. Kunstleri.

On trees overhanging the River Tahan.

This is a very different-looking plant, not only in its very much larger, almost obcordate leaves, but in its much larger and more oblong pink fruit. It is not common.

——, var. lutescens.

Never common, and usually at least terrestrial. A strict erect little-branched shrub, with narrow leaves. Fruit yellow.

Tahan Valley, rocks by the river.

Dr. King gives this species as sometimes a small tree. I have never seen it anything but a small shrub, rarely 5 feet high.

F. aff. geocarpæ, Teysm.

Woods, Tahan River.

Balanostreblus ilicifolia, Kurz.

Common. Temerloh, Kota Glanggi, Tembeling.

A very holly-like shrub or small tree, common in open country and woods. It produces good walking-sticks. It is called "Limau Lélang Antan" by the natives.

Conocephalus suaveolens, Blume.

Kwala Luit. A big climber with rather dull pink flowers.

C. amœnus, King.

Common. Renchong, Pekan. The flowers are white and have a strong smell of pears.

C. subtrinervius, Miq.

Kwala Tembeling.

A much smaller plant and less scandent than the other two; in fact, it does not usually climb at all. The flowers are in small compact balls of a beautiful pink colour, with a slight tint of violet.

Fleurya interrupta, Gaudich.

In waste ground in the villages, as at Pulau Tawar; also at Kamposa in Kelantan.

Laportea crenulata, Gaudich.

Is reported to be plentiful in Pulau Tiuman, and I have a live plant and some dried leaves from Kemaman, where, according to Professor Vaughan-Stevens, it is used in the manufacture of Ipoh poison.

Antiaris toxicaria, Blume.

This, the well-known "Ipoh" tree, I have not met with on the east coast, but I have no doubt that it occurs in Pahang, as it is the source of the arrow-poison of the Sakais here, and I have received leaves and a portion of a stem from Professor Vaughan-Stevens from Kemaman.

ARTOCARPUS RIGIDA, Blume.

Common, wild and cultivated. Kwala Tenok on the Tahan River, Tanjong Antan, and at Pulau Tawar, Pahang River, where there are some magnificent trees. This is the "Tamponet" of the Malays, the best by far of the sweet eatable *Artocarpi*. It is very superior to the Jack in flavour, and does not possess its disagreeable odour.

A. POLYPHEMA, Pers.

The "Champedak" is really wild in the woods of the Tahan Valley. It often occurs as an escape or relic of cultivation in Singapore and elsewhere, but I never saw it indisputably wild before.

A. KUNSTLERI, King.

At Kwala Tembeling.

This is the tree so well known as "Getah Terap." It is by far the commonest species of the genus in the Peninsula, but as it flowers only when full-grown it is not often collected. The latex is used by the natives as bird-lime, and used to entrap the turtle-doves known as "Tucucu" (*Turtur tigrinus*). These are caught with the aid of a decoy-dove, which is attached by a string on its leg to a stick, about 3 or 4 feet long, placed horizontally on a tree. The decoy sits on one end of the stick, the other end of which is smeared with the Getah Terap, on which the wild doves alight, and are thus caught. The bast layer of the tree is used for cloth by the Sakais.

PELLIONIA DUVAUANA, N. E. Br., var. **VIRIDIS**.

In damp woods on banks. Pulau Jellam, Lubu Lanjoot, Pahang River, and also in the Tahan River woods. It is common, too, in Malacca.

There are two forms of this plant, the commonest of which has rather broad green leaves (var. *viridis*), and has a somewhat different appearance; but the flowers seem to me identical with those of the plant described by N. E. Brown, which has rather narrower leaves, mottled with or entirely purple. This latter form is a native of the northern part of the Peninsula.

The leaves are succulent rather than fleshy. The stipules are pink. The male cymes are reddish; sepals olive-green, tinted with red, with green blunt keels. Anthers white, with a pink connective; loculi divaricate, filaments semi-transparent. Female flowers on different branches from those producing the males, sessile in small compact heads $\frac{1}{8}$ of an inch each way, much shorter than the pink stipules; very small. Bracts ovate acuminate, about equalling the short pedicel. Sepals five, lanceolate acute, gibbous at base, greenish, spotted with pink. Pistil oblong, rosy. Stigma penicillate, with very many white hairs. Achenes very small, oblong, black.

P. JAVANICA, Wedd.

Woods, Kwala Tembeling.

Two other plants apparently belonging to this genus occur in the limestone rocks of Kota Glanggi.

ELATOSTEMMA SESSILE, Forst.
On limestone rocks at Kota Glanggi.

E. LINEOLATUM, Wight.
Abundant on rocks in the Tahan Valley woods.

E. SURCULOSUM, Wight, var. ?
A weak thin plant on rocks at Kota Glanggi.

POUZOLZIA PENTANDRA, Benn.
Common in waste spots and open ground. Pulau Jellam, Lubu Lanjoot, &c., in the Pahang River, banks of Tahan, and also at Kamposa in Kelantan.

MYRICACEÆ.

MYRICA NAGI, Thunb.
A large thick bush, common on the sea-coasts, Kwala Pahang.

The fruit of this bush is very much smaller than that figured in the 'Botanical Magazine' (t. 5727), being not so large as a pea.

CUPULIFERÆ.

QUERCUS CANTLEYI, King.
Pekan (*Dr. Haviland*).

Q. REINWARDTII, Korth.
I found a fallen fruit-spike of what certainly appears to belong to this rare oak in the Tahan woods.

The scarcity of oaks in Pahang in comparison with Singapore is very remarkable.

CASUARINEÆ.

CASUARINA EQUISETIFOLIA, Forst.
Common along the sea-shore wherever there are tracts of sand, as at Kwala Pahang and Sungei Meang. The "Ru" tree grows in a single line along the sea-shores of both coasts. I have never seen it wild even a hundred yards inland, though it is often planted. It is one of the first plants to appear on newly-formed sand-islands along the coast, the seeds being drifted along in the sea. It was doubtless formerly a native of Singapore, as the name Tanjong Ru (Casuarina Cape) denotes, but it is quite extinct here now as a wild plant, having probably been destroyed here as elsewhere to make room for the coconut plantations. The statements which have been made that the tree grows also on Mount Ophir and other hills by explorers are incorrect, the *Dacrydiums* having been mistaken for it, as the native name Ru includes not only *Casuarina*, but also any pine-like tree.

SALICINEÆ.

SALIX TETRASPERMA, Roxb.

Common on the river-bank at Pekan.

GNETACEÆ.

GNETUM GNEMON, Linn.

Sir Joseph Hooker, in the 'Flora of British India,' refers to this species, with doubt, the scandent *G. Brunonianum*, Griff., which is certainly distinct in habit. What I take to be typical *G. Gnemon* is a good-sized tree with a stout stem about 20 feet high when full-grown. I have never met with this as a wild plant, but it is cultivated in Singapore and Penang. I found on the banks of the Tahan a small slender tree, or large shrub, with oblong-acuminate leaves and small orange drupes, eatable and sweet, which I suppose must be considered as a variety of this species, differing chiefly in the shape of the leaves.

G. BRUNONIANUM, Griff.

This plant, which appears to me in habit quite distinct and never passing into *G. Gnemon*, is a comparatively slender climber. I met with it at Pulau Tijau and Temerloh.

G. SCANDENS, Roxb.

Very abundant at Kwala Pahang, climbing extensively over bushes and trees in the thickets and draping them with its glossy-green leaves.

G. FUNICULARE, Blume.

A very large climber with green male flower-spikes. Tahan woods.

——, var.?

With very rough bark on the branches and narrower lanceolate-acuminate leaves, coriaceous, drying brown. Female spikes with rusty hairs round the ovules. Possibly a distinct species.

Pulau Rumput, Pahang River.

G. EDULE, Blume.

A lofty climber with much bigger seeds (2 inches long) than any other species known to me. They are sessile, elliptic acute, and dark brown. On very high trees in thick jungle, Tahan woods.

I have also received seeds of this from Kemaman, where the plant is said to be used by the aborigines in the manufacture of arrow-poison.

It has not hitherto been recorded from the Peninsula.

CONIFERÆ.

PODOCARPUS NEGLECTA, Blume.

A tree in the mangrove-swamps. Common. Kwala Pahang.

(*Note.—Dacrydium elatum*, Wall., recorded from "Singapore, Schomburgk," must be an error. It is a mountain-plant occurring at 2000 feet elevation only, and is not a native of Singapore.)

Cycadeæ.

Cycas Rumphii, Miq.
Woods on the sea-shores. Kwala Pahang.

MONOCOTYLEDONES.

Hydrocharideæ.

Hydrilla verticillata, Presl., var. **longifolia**.
The common form in all the muddy ditches of the Peninsula. Kwala Pahang.

——, var. **Roxburghii**.
Found floating in the Kelantan River.

Blyxa malayana, n. sp. Herba submersa, caule brevissimo. Folia plurima magnitudine valde variabili, sæpe 6-pollicaria, raro pedalia vel ultra-pedalia, circiter $\frac{3}{8}$ pollicem lata, linearia acuta, tenuia, integra, costa distincta, atro-viridia. Scapi 2–6-pollicares, plures complanati, $\frac{1}{8}$ pollicem lati. Spatha 2-pollicaris vel longior, sæpe flexa ad basin, anceps. Flos hermaphroditus, 4-pollicaris; ovarium complanatum. Sepala $\frac{3}{8}$-pollicaria, erecta, linearia, obtusa, rubescentia, tria. Petala tria, anguste linearia, alba, marginibus denticulatis, sepalis duplo longiora. Stamina tria, anguste linearia acuta. Antheræ terminales lineares. Granulæ pollinis aurantiacæ, globosæ, minute muricatulæ. Styli tres teretes acuminati, crassiusculi, staminibus longiores, albi, marginibus trichomatibus tectis. Capsula gracilis, subteres, $2\frac{1}{2}$-pollicaris, spatha inclusa. Semina copiosa, flavescenti-alba, elliptica, muricata et striata, apicibus obtusis, $\frac{1}{20}$-pollicaria.

Kwala Pahang in pools. Common also in Singapore and Malacca.

This is a very common plant, which, like almost all submersed plants, varies greatly according to the depth of water in which it grows. The above description is taken from specimens found in ditches in the Botanic Gardens, but the Pahang species is evidently the same one, though it is not in good condition. It grows quite submersed, the leaves lying flat upon the ground; the flowers, however, project from the surface of the water. It is very constantly in flower, but the flowers are short-lived.

Blyxa Griffithii, Planch. in Herb. Hook. (Fl. Brit. Ind. vol. v. p. 661), appears to consist of two or more species. It includes a nine-stamened plant collected by Sir W. Jones in Bengal, and by Parish at Moulmein; and specimens in fruit from Chittagong, collected by Sir J. Hooker, and by Griffith in Malacca and Mergui. I do not doubt that the Malacca specimens collected by Griffith belong to *B. malayana*, mihi, which is so abundant in Griffith's collecting-ground near Malacca; but, as that has only three stamens, the Bengal and Moulmein specimens must be distinct.

BURMANNIACEÆ.

BURMANNIA CŒLESTIS, D. Don.

Common and large; sandy spots at Pramau, near Pekan.

B. LUTESCENS, Becc.

At the foot of a lofty tree in Tahan woods; only three specimens found. The whole plant of a yellowish-white colour. This fits Beccari's description of the plant, which he got at Mattan in Borneo, fairly well, and will not agree with any other known to me.

THISMIA ASEROE, Becc.

In the woods at Kota Glanggi.

I will take the opportunity here to mention that I have been fortunate enough to meet with a species of *Geomitra*, apparently *G. episcopalis*, Becc., in Perak. I found two specimens, one in fruit, the other in flower, in the dense jungles on the Larut Hills, near the Tea Gardens, and on the slopes of Gunong Hijau. The very small plant had a thick mass of roots at the base, forming a tuber-like structure. The flower was burnt-sienna coloured (not "croceus" as Beccari describes), so perhaps it may be a distinct species. This is a new genus for the Peninsula.

ORCHIDEÆ.

OBERONIA INSECTIFERA, Hook. f.

Kwala Tahan.

O. ANCEPS, Lindl.

Passir Loyang, Pahang River.

This is the commonest species of *Oberonia* here, and is easily known by its long stems covered with the rather short curved leaves, and its rat-tailed spike of ochre-yellow flowers so closely crowded that the lips seem to be the only portion of the flower visible. The lips are retuse rather than crenulate.

LIPARIS ELEGANS, Lindl.

Pramau woods, near Pekan.

This plant, so long obscure, proves to be the commonest species of the genus in the Straits. It is almost a terrestrial plant, growing often on the ground or on old stumps in dry woods.

L. (§ CORIIFOLIÆ), sp.

A narrow-leaved plant, with rather short conical pseudo-bulbs, with fruit only; near *L. latifolia*, but leaves much narrower. On wet mossy trees overhanging a small stream in the Tahan Valley.

L. DISTICHA, Lindl.

Limestone rocks above the caves, Kota Glanggi. This is not mentioned from the

Malay Peninsula in the 'Flora of British India,' but it is quite common, though local. Usually very plentiful where it occurs. I have it from Kranji, Toas, &c., in Singapore, where it grows on trees near mangrove-swamps, and from Kwala Lumpur caves in Selangor, collected by Mr. Kelsall, a similar locality to that of Kota Glanggi. There is also a sketch of it in Scortechini's drawings.

The flowers are of a pretty apricot-orange.

PLATYCLINIS LONGIFOLIUS, Benth.

This plant, which is common in Singapore and elsewhere, is not recorded in the 'Flora of British India.' I saw what were evidently plants of it out of flower growing with other orchids on boughs of *Dipterocarpeæ* overhanging the River Tahan. The Singapore plant was identified for me by Sir Joseph Hooker. It was originally described in the 'Botanical Register' by Lindley from living plants sent by Cuming from the Philippines. It was stated there to have green flowers; however, the petals and sepals are yellow, and the lip is brown.

DENDROBIUM (§ BOLBODIUM) PUMILUM, Roxb.

A very common little plant. Pekan, Pramau, Kota Glanggi, &c., growing on orchard trees, bushes on the heath country, and in more open woods. Both the yellow-flowered and pink-veined varieties are equally common, and often grow together.

D. (§ CADETIA) LONCHOPHYLLUM, Hook. f.

Tahan woods.

The flowers of this plant are whitish with pink veins, the base of the lip deep maroon-pink, the terminal lobes orange. It is very common in Singapore, and indeed elsewhere. The flowers remain open only about six hours.

The species of this section are very troublesome to make out from dried specimens. The pseudo-bulbs, which give good characters, are crushed in drying, so that one cannot be sure whether they were flat or round. The flowers are thin in texture, and easily crushed out of shape, and are, moreover, very short-lived. The only way to study these plants is to cultivate them, when one can usually with ease obtain flowers fit to dry. It is not common to find them in good condition in the jungle. There are only two species mentioned from the Peninsula in the 'Flora of British India.' I have five or six more, very distinct ones.

D. (§ APORUM) LEONIS, Reichb. f.

Common. Kwala Pahang, Guai, Pulau Tawar woods.

D. SERRA, Lindl.

Common. Pramau, Kwala Pahang.

D. RHODOSTELE, n. sp. Planta cæspitosa, *D. Serram* multo simulans. Caules 12–15-pollicares vel ultra, foliis dense tecti, portione terminali excepta, nodis flavis, internodiis flexuosis inferioribus $\frac{1}{4}$ pollicem latis, superioribus angustioribus. Folia atro-viridia; laminis lanceolatis vel ovato-lanceolatis acutis, $\frac{3}{4}$ ad 1 pollicem longis, $\frac{1}{4}$ pollicem latis (siccis multo striatis); vaginis $\frac{1}{2}$-pollicaribus; folia caulis superioris partis vaginis reducta. Flores minimi in fasciis bractearum siccorum, circiter $\frac{1}{8}$ pollicem longis, e basibus internodiorum terminalium exortis, singulatim expansi, albi, ovarium cum pedicello gracili $\frac{1}{8}$-pollicari. Sepala ovata obtusa, mento brevi, lato, obtuso, sepalis subæquali. Petala linearia acuta, sepalis ferme æqualia. Labellum cuneatum, angustum, lobi laterales obsoleti, medius bilobus rotundatus, magnus. Columna grandiuscula, longior et latior quam in *D. Serra*, rosea. Anthera lata et complanata. Pollinia angusta linearia, læte flava. Clinandrium magnum, stigma oblongum. Capsula pyriformis, sepalis marcidis coronata, $\frac{1}{4}$-pollicaris, pedicello elongato, incrassato.

On trees, in dense jungle, far up the Tahan Valley.

In the live plant the most conspicuous difference between this plant and *D. Serra* is the pink column, which is white in the commoner species. There are other much more important characters to be seen on looking closer into the two, however. The pedicels of the flowers are longer, and the column much larger, in *D. rhodostele*. The lip is very different. In *D. Serra* the lateral lobes are well developed and upcurved so as to meet the column, while the terminal lobe is small and narrow and bilobed, with the two parallel oblong lobes narrower than the rest of the lip. In *D. rhodostele* the lateral lobes are hardly to be traced, the blade of the lip lies flat against the column, and the edges are not curved up, while the terminal lobe is broader and rounded. The column is broader and thicker, rose-colour instead of white, with a broader flat anther, and an oblong instead of ovate stigma.

Dendrobium grande, Hook. f.

A fallen plant without flowers. Banks of Tahan River.

D. atropurpureum, Miq.

Common. Pramau, Pekan.

D. (§ Strongyle) acerosum, Lindl.

Common on bushes. Pramau, Pekan; Blay Manis.

D. (§ Virgatæ) clavipes, Hook. f.

Pulau Chengei.

I also saw the same plant without flowers in the Tahan woods. The flowers are white, except the orange callus on the lip, and the veins on the side-lobes, which are pink.

I believe this to be the plant intended by Sir Joseph Hooker for *D. clavipes*, but the flowers (in life at least) are more than a quarter of an inch long, and the mid-lobe, though small, I should hardly have called minute. It is probably variable in this respect. There is a sketch of it, under the name *D. truncatum*, in Scortechini's drawings.

Dendrobium (§ Pedilonum) pyropum, n. sp. Caules circiter pedales, graciles, subflexuosi, internodiis pollicaribus, haud compressis, costatis. Folia lanceolata acuta, valde inæqualiter biloba, lobo uno $\frac{1}{4}$–$\frac{1}{2}$ pollicem longiore acuto (siccitate 6-costata), 3–4 pollices longa, $\frac{3}{4}$–1 pollicem lata, vaginis striatis pollicaribus, ore integro. Racemi penduli a parte superiore caulium nudorum, 2–3 flori, circiter pollicares, rhachide tenui purpurea. Bracteæ parvæ, ovatæ. Flores magni, aurantiaci. Sepala lanceolata subacuta; petala ferme æqualia, pollicaria. Labellum spathulatum, basi angusta lineari, apice rotundato, denticulato, crispo, linea mediana elevata a basi, callo nullo, omnia aurantiaca, punctis kermesinis ad basin labelli. Columna flavescens, superne dilatata, margine postico clinandrii elevato rotundato, filamento triangulari, clinandrio profundo; rostellum linguiforme, majusculum, apice rotundato. Anthera ovoidea, apice obtuso, margine lato, rotundato, integro. Stigma basi dilatatum, superne attenuatum.

On mossy trees along a stream in the Tahan Valley.

This is a charming plant, the flowers being of a very bright orange.

D. crumenatum, Sw.

Common on trees in and around Pekan.

D. tuberiferum, Hook. f.

This is a local plant, but widely scattered. I have met with it several times in Singapore and at Kwala Pahang. The Chittagong plant, doubtfully referred to this species by Sir J. Hooker, is certainly different, and as it has been confused with it, it will be as well to give a complete new description of the Malayan species.

Caules plures erecti, congesti, circiter pedales, raro ramosi, purpurei, basibus (pollicaribus) angustatis, dein subito dilatatis (internodii duobus), ovalibus compressis, $1\frac{1}{2}$ pollices longis, pollicem latis, $\frac{1}{4}$ pollicem crassis; parte superiore caulis gracili, complanata. Folia in caulibus lateralibus brevibus elliptica ovata, coriacea, apice minute inæqualiter bilobo, atro-viridia, marginibus rubris, rarius omnino rubro-purpureis. Flores pauci in caulibus nudis dissiti, fugaces, nutantes, iis *D. crumenati* similes, sed minores. Sepalum posticum lanceolatum acutum, album, linea media et apice kermesino-violaceis, $\frac{1}{4}$-pollicare; lateralia triangularia acuta, mentum breve, quam sepala paullo longius, apice gibbo. Petala lanceolata acuta, sepalis breviora, alba, linea mediana violacea. Labellum paullo longius, lobi laterales curvi rotundati, albi, roseo-venosi, lobus medius angustus, lanceolatus acutus, ciliatus, apice decurvo, discus violaceo-roseus, marginibus et ciliis albis; callus retusus flavescens inter lobos laterales. Columna gracilis, alba.

D. (§ Breviflores) hercoglossum, Reichb. f.

Pulau Tiuman (*W. Nanson*).

D. (§ Pedilonum) secundum, Wall.

Abundant on trees at Kwala Pahang

Dendrobium Hosei, n. sp. Caules longi, ultra bipedales, flexuosi, angulati, $\frac{1}{8}$ pollicem crassi, cæspitosi. Folia plura, lanceolata acuminata, acuta, apicibus valde inæqualibus, tenuia, superne lævia, subtus striata, 3 pollices longa, $\frac{3}{8}$ pollicem lata, vaginis ore obliquo $\frac{3}{4}$-pollicaribus. Racemi e basi internodiorum $\frac{3}{4}$ pollicem longi, 3–4-flori, rhachidibus gracilibus. Bracteæ ovatæ, acutæ, $\frac{1}{16}$-pollicares, ovarium cum pedicello $\frac{3}{8}$-pollicare. Sepala oblonga, ovata, acuta, lateralia quam posticum majora; mentum angustum, rectum, apice paullulo dilatato, sepalis subæquale. Petala angustiora, oblonga, linearia, omnia alba. Labellum latum, panduratum, $\frac{3}{8}$ pollicem longum et ferme æquilaterale, lobis lateralibus acutis, curvis, latis, medio reniformi retuso, margine sinuato, minute ciliato, nervis tribus elevatis, brunneis, parallelis, apicibus incrassatis, ochreum, nervis brunneis. Columna basi lata, superne attenuata, brunnea. Anthera ovoidea, alba, minute pubescentia, margine recto. Stelidia erecta, acuta, viridia. Stigma rotundatum, album.

On trees overhanging the Tahan River. Also sent from Borneo by Bishop Hose.

The specimens I collected in the Tahan River were nearly all monstrous, having three anthers to the flower, the lateral anthers being on long subulate filaments.

It is difficult to refer this, as well as one or two allied species, to any of the sections of the genus in 'Flora of British India,' but in many points it is allied to the section *Distichophyllæ*.

D. (§ Distichophyllæ) bifarium, Lindl.

On trees in the Tahan River. This is a common plant in the Peninsula. The 7 to 9 close-set ridges on the lip, described by Sir Joseph Hooker, are visible only when the plant is dry; when the plant is living the whole lip has a mealy appearance without any ridges.

(*D. uniflorum*, Griff. Notul. iii. 305; Ic. Pl. As. 303, which is quoted as a synonym of *D. revolutum*, Lindl., in the 'Flora of British India,' is a perfectly distinct species. The stems are smaller and more slender at the base, enlarging upwards. The flowers are eventually wide opened, and the sepals are not reflexed. The whole perianth is broader in proportion to its length. The lobes of the lip are larger and more spreading, the median one distinctly bilobed, not merely emarginate. The lip is white and not orange. In *D. revolutum* it is not possible to unroll the lip without breaking it, as it is so firmly rolled up beneath; while in *D. uniflorum*, Griff., it is nearly flat, and can easily be spread out quite flat without breaking. The keels of the lip in the former run nearly parallel from the base of the lip towards the mid-lobe, while in the latter there are two short keels arising from the base, and no longer than the base of the mid-lobe, while the median ridge rises from the base of the mid-lobe and runs to the notch in the apex. The column, too, in *D. revolutum* has two thick conical ridges at the base, with a groove between them, which are absent in *D. uniflorum*. *D. revolutum*, Lindl., I have received from Batu Pahat in Johore.

Dendrobium uniflorum, Griff., is abundant on Mount Ophir, and I have also gathered it on trees at Maxwell's Hill in Perak.)

DENDROBIUM (§ EUDENDROBIUM) LAMELLATUM, Lindl.

Kwantan (*Mr. Durnford.*).

The varieties of colour represented in drawings of this plant are due to the different ages of the flower, which, when it opens, is white, but soon turns yellow, as in the figure in the 'Botanical Register' (1844), t. 53.

Another *Dendrobium* of this section was found in fruit on trees overhanging the River Tahan, but I cannot identify it.

BULBOPHYLLUM CLANDESTINUM, Lindl.

Trees on the Tahan River.

B. MACRANTHUM, Lindl.

Pramau woods, near Pekan. Common. *B. gelatinosum*, Teysm. & Binn. (in Herb. Bogor.), is apparently identical with this; I have seen a flowerless type in the Buitenzorg herbarium. It is not uncommon to find on the rhizome a quantity of a shiny gelatinous substance, apparently an alga resembling *Nostoc*, whence I imagine Teysmann and Binnendyck may have given the name.

B. MEDUSÆ, Reichb. f.

I collected a living plant of this, which flowered on the way home.

B. ODORATUM, Lindl.

Tahan River woods.

I have little doubt that this is what was intended by Blume in his meagre description of *Diphyes odorata*. It is allied to *B. stenobulbon*, Par. & Reichb. f., but is a bigger plant with smaller flowers, orange in bud, white when open. I have received it also from Borneo and Java. It is omitted from the 'Flora of British India.'

CIRRHOPETALUM VAGINATUM, Wight.

Common at Pekan, Kota Glanggi, and Cherating River.

C. PLANIBULBE, n. sp. (Pl. LXIV.) Caules plures, gracillimi, rubri, majore parte vaginis griseis tecti, pseudobulbis ellipticis, oblongis, complanatis, decumbentibus, caule appressis, pollicaribus, atro-rubentibus. Folium oblongum, apice bilobum, pseudobulbo æquale, carnosum. Scapus e basi pseudobulbi enatus, patulus, gracilis, purpureus, vaginis parvis tribus ovatis. Flores racemosi 5, approximati. Bracteæ ¼-pollicares, lanceolatæ acutæ, pallidæ. Pedicelli graciles, rubri, pollicares. Sepalum posticum erectum, lanceolatum acutum, caudatum, pollicem longum, rufescenti-purpureum, marginibus pallide flavis; lateralia deflexa, libera, 2 pollices longa. Petala læte spathulata, ochreo-flava, obtusa, columnæ æqualia. Labellum linguiforme acutum, superne canaliculatum, flavum. Columna brevis, flava. Stelidia gracilia, setacea. Anthera magna, apice obtuso. Pollinia magna, semiovoidea, læte flava.

Trees on the heath-district at Pekan and Kwala Pahang. I have since met with it again at Yan, in Kedah, growing on Durian trees.

A very curious little plant, distinguished from all others known to me by the pseudobulbs lying flat on the very slender stems, which thus traverse them for their whole length and are adnate to them.

As the flowers are not strictly umbellate, as in typical *Cirrhopetalum*, this might very well be classed with *Bulbophyllum*. The flowers, however, so much resemble those of *Cirrhopetalum* that I class it here provisionally.

Cirrhopetalum (§ Ephippium) Restrepia, n. sp. Rhizoma breviusculum, pseudobulbis approximatis, parvis, cylindricis, viridibus, $\frac{3}{4}$-pollicaribus. Folium obovatum, petiolatum, 2 pollices longum, 1 pollicem latum, læte virens. Scapus uniflorus, ferme 4-pollicaris, filiformis, parte superiore incrassato, vagina singula in medio. Flos mediocris. Sepalum posticum lineare, superne attenuatum, apice clavato, marginibus supernis involutis, lateralia obliqua, lanceolata acuminata, marginibus ad basin et apices connatis (parte mediana libera), pollicem longa, $\frac{1}{4}$ pollicem lata, omnia flavescentia, kermesino-punctata, præsertim versus bases. Petala minima, vix $\frac{1}{4}$-pollicaria, viridia, marginibus brunneis. Labellum petala haud superans, carnosum, ovatum, apice decurvo, minute atro-punctato. Columna brevis et crassa, smaragdina. Anthera quadrata. Stelidia bifida, lobo postico quam anticus breviore.

On bushes, especially those of *Vaccinium*, at Pramau, near Pekan.

The genus *Ephippium* was founded by Blume for a Javan plant (*E. ciliatum*), which Lindley referred to the genus *Cirrhopetalum* (*C. Blumii*). It differs from typical *Cirrhopetalum* in the scape bearing but one large flower, instead of a whorl; in fact *Ephippium* bears much the same relation to *Cirrhopetalum* that *Sarcopodium* (*Sestochilus*) does to *Bulbophyllum*. There are several other species of this section in the Malay Peninsula. The above-described one is dull-coloured, but the form of the flower recalls that of the South-American Restrepias, whence the specific name.

Cœlogyne Forstermanni, Reichb. f.

A very fine *Cœlogyne* with white flowers as large as those of *C. cristata*, Lindl., was brought from Kuantan by Mr. Durnford. I met with it also on a tree overhanging the Tahan River. Mr. Boxall, on seeing a sketch of it, recognized it as the long-lost *C. Forstermanni*, Reichb. f., a plant described from Messrs. Sanders' garden, which was stated to have come from the "Sunda Islands." It is quite possible that *C. Maingayi*, Hook., is a synonym, for, except that the leaf and pseudobulb are smaller, I cannot see any difference in the description of the two plants. I will give a description of the Kuantan plant:—

Herba pro genere magna, pseudobulbis elongatis, conicis, 5 pollices longis, pollicem crassis, profunde canaliculatis, remotis. Folia lanceolata acuta, basi angustata, plicata, atro-viridia, circiter 15 pollices longa, $2\frac{1}{2}$ pollices lata. Racemus lateralis nutans, 15-pollicaris, ad basin vaginis pluribus viridibus, superioribus majoribus, siccis flavescentibus, usque ad flores tectus. Flores speciosi 9, magni, remoti. Bracteæ angustæ, lanceolatæ acutæ, flavescentes, 2 pollices longæ, persistentes. Pedicelli cum ovariis 1½-pollicares, in pulvino brevi sessiles. Sepala lanceolata acuta, 1½-pollicaria, alba. Petala latiora. Labellum magnum, lobis lateralibus latis, acutis, albis, apicibus et striis castaneis; lobo medio late ovato-acuto, marginibus crispis, carinis 5-cristatis, mediis longioribus, albo, disco flavo, maculis rubris paucis ornato. Columna parum curva, dorso convexo albo, marginibus ochreis, dorso clinandrii emarginato, denticulato. Anthera conica. Rostellum magnum, emarginatum. Stigma ovatum.

Both *Cœlogyne Forstermanni* and *C. Maingayi* are described as having three keels on the lip; the two outer ones are, however, low, and might be overlooked in dry specimens, or might hardly be developed, as sometimes happens in the genus.

ERIA (§ DENDROLIRION) PULCHELLA, Lindl.

Common at Ayer Hitam, near Pekan, and on Pulau Tiuman. Common all over the Peninsula.

E. PANNEA, Lindl.

On trees in the Tahan valley.

E. STELLATA, Lindl. (? *Dendrobium perakense*, Hook. f., Ic. Pl. 2019.)

On limestone rocks, Kota Glanggi.

Not a common plant anywhere in the Peninsula, though plentiful in Borneo. I am quite unable to distinguish the plant figured as *Dendrobium perakense* from this species. There is no figure or description of the pollinia in the 'Icones Plantarum.' Those of *E. stellata* are those of a true *Eria*, not of a *Dendrobium*. The column is represented as acuminate in the figure, which I certainly never saw in *E. stellata*; nor is it so represented in a drawing by Scortechini labelled *Dendrobium perakense*.

E. (§ TRICHOTOSIA) VESTITA, Lindl.

Pramau woods, Pekan.

E. (§ TRICHOTOSIA) GRACILIS, Hook. f.

A single plant fallen from a high tree, Tahan woods. Flowers pale yellow.

E. FLORIBUNDA, Lindl.

On trees overhanging the stream, Tahan woods.

E. BRACTESCENS, Lindl.

Common on bushes in the heath country at Pramau. One of the prettiest species in the genus.

E. AËRIDOSTACHYA, Reichb. f.

On bushes, Kwala Pahang.

In the 'Flora of British India' this is written *acridostachya*, but in the original publication it is *aëridostachya*, evidently from a supposed resemblance to an *Aërides*.

Sir Joseph Hooker says that the scapes arise from the base of the pseudobulb, but in the Pahang plant and also in a drawing by Scortechini labelled *E. acridostachya* they arise from the top or near it.

It is not a common plant; I have also obtained it from Johore.

CLADERIA VIRIDIFLORA, Hook. f.

Tahan woods.

It seems curious that so common a plant as this should have escaped the eyes of botanists so long. It is very abundant in Singapore, even wild in the Botanic Gardens jungle. It is, however, not often met with in flower.

AGROSTOPHYLLUM LONGIFOLIUM, Blume?

Kwala Pahang.

This is the common species of the genus here, but it is omitted from the 'Flora of British India.' I should imagine *A. majus*, Hook. f., to be intended for it, if that had two tooth-like bosses on the epichil. The flowers are white, fading yellow. It is probably Blume's *longifolium*.

A. PAUCIFLORUM, Hook. f.

On trees, Tahan woods.

Evidently the plant figured in 'Icones Plantarum,' t. 2097; yet I hardly think it is an *Agrostophyllum*, but rather consider it to be an *Eria*. The few flowers I have were in a poor state.

CERATOSTYLIS, sp.

Apparently new; far up the Tahan River. The only specimen was too incomplete for identification.

CŒLOGYNE MACROBULBON, Hook.

Not rare, Pramau woods, Tahan valley, on trees or on the ground.

C. CUMINGII, Lindl.

I found a plant of this fallen from a lofty tree, and almost perished, in the Tahan woods.

C. SPECIOSA, Lindl.

Tahan River; on mossy trees in the woods; in fruit.

CALANTHE CECILIÆ, Reichb. f.

Woods, Kota Glanggi. Flowers violet with orange calli.

This appears to me to be near *C. masuca*, Lindl. It is a lovely plant, and the flowers are more violet than the typical form, which grows on the Hermitage Hill in Perak.

C. VERATRIFOLIA, R. Br., is very abundant near Sedili River, on the east coast of Johore.

ARUNDINA SPECIOSA, Blume. (*A. densiflora*, Lindl.)

Rocky islets in the Tahan River.

The locality Singapore in the 'Flora of British India' is, I am sure, an error. There no likely spot for it to grow in Singapore.

VANDEÆ.

EULOPHIA SQUALIDA, Lindl.

Common by the Sedili River, Johore.

E. GRAMINEA, L

Sandy places near the sea: Rumpin; Kwantan; Sungei Meang. Common.

CYMBIDIUM ALOIFOLIUM, Swartz.

Pekan, Kwala Pahang. Common, open woods, orchards, &c.

Of this common orchid I have had under cultivation several forms; and having compared the broad, thick-leaved, large-flowered form (*C. Finlaysonianum*) with the figures of *C. aloifolium*, Sw., and with forms from India, I cannot see any really specific difference. *C. pubescens*, Lindl., is very different-looking, at first sight, from this species, but I have found forms intermediate between the two. It is probable that it will be found to be only a variety. Another form occurs in Perak, with narrow leaves and erect flower-spike, the flowers resembling those of *C. aloifolium*, Sw., but differing slightly in colour. It is possible that there is but one variable species extending from the Himalayas to China and the Malay Peninsula.

DIPODIUM PICTUM, Reichb. f.

Tahan woods; Kota Glanggi. Common.

If this fine plant were more floriferous, it would be one of the most popular of the Malay orchids, but, unfortunately, it is rare to find even traces of flowers in the wild state, and it very seldom flowers under cultivation.

BROMHEADIA PALUSTRIS, Lindl.

Pramau, near Pekan.

B. ALTICOLA, Ridl.

I found a piece of this fallen from a high tree in the Tahan woods.

PLOCOGLOTTIS JAVANICA, Blume.

Common in the Pulau Tawar woods and at Kota Glanggi.

Blume's figure (Orch. Archipel. Ind. t. 14) makes this appear a much finer plant than it really is, here at least, by representing a number of flowers open at a time. Here one or two only open at once.

P. PORPHYROPHYLLA, n. sp. Pseudobulbi plures in rhizomate brevi, conici, olivacei, purpurei, superne attenuati, 3 pollices longi, ½ pollicem lati, primo vaginis siccis

tecti, mox nudi. Folia singula, lanceolata acuta, plicata, ad basin angustata, 1½-pedalia, 4 pollices lata, superne atro-purpureo-viridia, nitida, subtus læte purpurea. Scapi erecti, laterales, 1–2-pedales, purpurei, graciles, erecti, pubescentes, bracteis paucis dissitis. Racemus terminalis, floribus singulatim expansis, pluribus dissitis mediocribus. Bracteæ lanceolatæ acuminatæ, ¼ pollicem longæ. Ovarium gracile, pubescens, olivaceum, ½ pollicem longum. Sepalum posticum loratum, apice recurvo, vix ½ pollicem longum, ⅛ pollicem latum, pallide flavum, lateralia obliqua, aurita, curva, margine interiore incrassato, involuto, flavescentia, maculis atro-roseis in angulo interiore. Petala angusta, linearia acuta, quam sepalum posticum longiora, flava. Labellum breve, ferme quadratum, ¼-pollicare, marginibus ad basin recurvis, apice lato, angulis exterioribus contortis, dente mediano, carnosum rubrum. Columna ¼-pollicaris, curva, flava, basi kermesina, superne clavata. Clinandrium profundum, margine dorsali subintegro. Anthera —— ? Stelidia rotundata, crassa, brevia. Stigma majusculum. Capsula 1½-pollicaris, ¼ pollicem crassa, angusta, oblonga, versus basin attenuata, costæ æqualiter carinatæ, carinis prominentibus, rotundatis.

Pekan, in Pramau woods.

I suppose this common plant has been passed over as *P. acuminata*, Blume, but it differs from Blume's description in the sepals and petals not being at all acuminate. It is very common in many parts of the Peninsula, from Singapore northwards, and I have also received it from Rhio. The flowers are inconspicuous and dull-coloured, but the leaves are of a fine purple, and the transmitted light of the sun towards evening, when it is low, causes them to resemble pieces of stained glass.

LUISIA ANTENNIFERA, Blume.

On low trees, Pulau Chengei, &c., on the Pahang River.

ARACHNANTHE ALBA, n. sp. Caules 10–20-pedales, paullo compressi, ⅛ pollicem crassi, fragiles, radicibus copiosis, longissimis. Folia lorata, obtuse inæqualiter biloba, 3 pollices longa, 1½ pollicem lata, vaginis subcompressis, viridibus, purpureo-punctatis, ore emarginato. Panicula longa, flexuosa. Flores ad 10, dissiti, magni, speciosi, pedicellis elongatis. Bracteæ ovatæ, cucullatæ, mediocres. Sepala linearia, spathulata, obtusa, marginibus revolutis, 1½-pollicaria, ¼ pollicem lata, omnia alba, similia. Petala paullo minora. Labellum parvum, lobis lateralibus latis, rotundatis, majusculis, flavescentibus, kermesino-punctatis, lobo medio linguiformi subacuto, subintegro, roseo-violaceo, striis medianis obscurioribus; disco inter lobos laterales, 2 striis violaceis, et maculis aurantiacis 2. Columna crassa, recta, semiteres, flavescens, striis violaceis, ventre albo, marginibus violaceis. Anthera pileata, obtusa, margine producto, truncato, aurantiaco.

Climbing in and through bushes on the heath-district of Pramau and Kwala Pahang. It is also remarkably abundant on the small island in the Johore Strait known as Pulau Selitar: there the low trees are covered with it, the roots forming a dense curtain all through the undergrowth, not at all easy to penetrate. In hot and dry spots the

stems are hard and brittle, the leaves short and firm; but some that I planted in a shady place in the garden developed longer and narrower more flaccid leaves *.

The flower is very pretty, but is not of a sufficiently pure white to be really fine.

CLEISOSTOMA (§ SARCANTHUS) CRISTATUM, n. sp. Caulis brevis. Folia patentia, 2 pollices longa, $\frac{1}{2}$ pollicem lata, crassa, apice bilobo, lobis subæqualibus, obtusis, apicibus rotundatis, carinata, vaginis striatis, brunneis. Racemi breves, pauciflori, rhachide versus apicem incrassata, bracteis ovatis, brunneis, amplexicaulibus. Flores $\frac{3}{8}$ pollicem lati, carnosuli, pedicellis brevibus, crassis. Sepalum posticum oblongum, spathulatum, lateralia falcata, omnia carinata, carina læte viridi, elevata, acuta, cristata, versus apicem altiore, flavescentia, striis kermesinis. Labellum lobis lateralibus angustis, longis, erectis, apicibus incurvis, lobo medio cordato acuminato, disco depresso, apice decurvo, album, maculis 1–2 roseis. Calcar crassum, magnum, conicum, scrotiforme, flavescens, nervis roseis. Callus clavatus, in fauce calcaris, costis paullo elevatis obscuris, 2 in utroque latere. Columna alba, brevis, crassa, medio contracto. Clinandrium ferme planum. Stelidia elongata, dentiformia, incurva, subacuta, clinandrium multo superantia. Anthera subbilocularis, rostro longo, oblongo-truncato, retuso. Pollinia profunde canaliculata, ad dorsum elliptica, aurantiaca, pedicello brevissimo, lato, quam discus minore, crassus, bidentatus, disco magno, subquadrato, profunde emarginato. Rostellum deflexum, bilobum, lobis obtusis. Stigma profundum, margine inferiore recto.

Kota Glanggi. A small plant which was brought with other orchids from the limestone rocks and flowered in the Botanic Gardens. It is remarkable for its crested sepals and the curious structure of the pollinia.

C. LATIFOLIUM, Lindl.

Temerloh.

A very big plant, climbing in trees; stems over four feet in length.

SARCANTHUS SCORTECHINII, Hook. f.

Trees at Kwala Tenok, Tahan River; Kota Glanggi.

TÆNIOPHYLLUM SERRULA, Hook. f.

What I take to be intended by this species is very common at Pramau, Pekan, and at the Cherating River.

MICROSACCUS JAVENSIS, Blume.

Trees on the top of the rocks at Kota Glanggi.

ADENONCOS VIRENS, Blume.

Kota Glanggi.

This curious little plant, which is common in the mangrove-swamps in Singapore, appears to me to be very distinct generically from *Microsaccus* in having no spur. I take it to be an ally of *Cottonia* and *Luisia*, whereas *Microsaccus* is nearly allied to *Saccolabium*. The little green flowers have a strong smell of Friar's balsam.

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* See a note on this by Mr. Groom in 'Annals of Botany,' March 1893, p. 152.

Sarcochilus lilacinus, Griff.
Climbing over bushes, Pekan.

S. calceolus, Lindl.
Kwala Tenok, Tahan River.

This common Malayan plant is omitted from the 'Flora of British India.' It occurs usually on the sea-coast, covering rocks with a dense mass of stems. The flowers are large and beautiful, but have the great defect of almost all the Sarcochiles in being very short-lived.

S. hirtulus, Hook. f.
Abundant on trees on the limestone rocks, Kota Glanggi; Pulau Chengei; River Tahan.
Flowers white, with pink spots.

S. trichoglottis, Hook. f.
On orchard trees, Pekan, Tanjong Antan.

This is so common in Singapore as to be an absolute nuisance on the trees. The flowers are yellowish white, the lip similarly coloured, with some ochre spots on the lateral lobes outside, and an orange callus in the centre.

S. (§ Fornicaria) pardalis, n. sp. Caules graciles, flexuosi, ad 10-pollicares, sæpius breviores, radicibus pluribus longis. Folia lanceolata, lorata, obliqua, læte virentia, carnosa, apicibus inæqualiter biloba, lobis acutis, 2 pollices longa, ¼ pollicem lata; vaginis ferme ½-pollicaribus (siccis striatis). Scapi in plantis majoribus pluribus singulatim aut binatim e parte inferiore internodii exorti, 6–10-pollicares, graciles, erecti. Racemus terminalis congestus, brevis vel elongatus, ad bipollicarem. Bracteæ basibus latis, apicibus subulatis, patentibus, ⅛-pollicares, squarrosæ. Flores vix ½ pollicem lati, singulatim expansi. Sepala ovata, obtusa, alba, maculis kermesinis ornata. Petala breviora et multo angustiora, linearia, oblonga, alba, maculis kermesinis. Labellum obcuneatum, lateribus involutis, tubiforme, apice obtuso, flavescens, rubro tinctum, lanugine alba (præsertim ad apicem) tectum; callus oblongus, linearis, obtusus, medius dimidio labelli æquans. Columna brevis, crassa, ventre excavato, stelidiis approximatis, alba. Anthera ovata, obtusa, complanata. Pollinia 2 elliptica, disco rotundato. Stigma subcordatum, profundum.

On low trees in thickets and open country; common far up the Pahang River, at Pulau Chengei, Tulomalaty, and Kalambalai.

This is one of the set of *Fornicaria Sarcanthi* in which the lip is rolled up into the form of a trumpet, woolly at the mouth, and the lateral lobes are suppressed. It is nearly allied to *S. trichoglottis*, Hook. f., but is very distinct in its longer and slenderer scapes, squarrose bracts, and the colouring of the flower. It is a very pretty little plant, though the flowers are as fugacious as those of the very common *S. trichoglottis*.

Sarcochilus psiloglottis, n. sp. Caulis brevis, gracilis, 1½-pollicaris, radicibus copiosis, longis, gracilibus. Folia lorata, 2 pollices longa, ¼ pollicem lata, basi angustata, apice obtuso rotundato, breviter bilobo, vaginis brevibus. Scapi erecti, 3-pollicares. Racemus brevis, ¼-pollicaris, rhachide haud incrassata. Bracteæ lanceolatæ acuminatæ, subulatæ, ferme ¼-pollicares, patentes, recurvæ. Flores minimi, circiter ¼-pollicares. Sepalum posticum lanceolatum acutum, pallide flavum, lateralia triangularia, acuta, flava, macula aurantiaca ad basin. Petala subspathulata, flava. Labellum breve, lobi laterales lineares, porrecti, quam lobus medius multo majores, albi; lobus medius obtusus, decurvus, carnosus, apice calceolato, albus, macula mediana aurantiaca; basis labelli subcalcarata. Columna alba.

On a tree at Kwala Pahang.

A small plant resembling *S. trichoglottis*, Hook. f., but with distinct lateral lobes to the glabrous lip.

S. tanyphyllus, n. sp. Caulis brevissimus, vix pollicaris, radicibus elongatis, crassis. Folia 4–5, lorata, longissima, pedalia vel ferme bipedalia, 1½ pollices lata, inæqualiter biloba, obtusa, atro-viridia. Racemi breves, crassi, 4–5-pollicares, ferme omnino floriferi, rhachide superne vix incrassata. Bracteæ quaquaversæ, lanceolatæ, persistentes, $\frac{3}{16}$-pollicares. Flores iis *S. Calceoli*, Lindl., subæquales et subsimiles, albi, pedicellis pollicaribus. Sepala lanceolata acuminata acuta. Petala latiora, lanceolata subacuta. Labellum quam sepala brevius, unguiculatum, unguicula linearis, lobis lateralibus loratis, falcatis, obtusis, magnis; lobo medio calceolato obtuso, carina magna ad basin. Columna brevis, crassa, clinandrio haud profundo. Anthera magna, apice depresso, margine rostrato, truncato. Pollinia elliptica, pedicello cuneato-oblongo, truncato, disco triangulari, lato. Rostellum bifidum, lineare acuminatum. Capsula breviuscula, 1½-pollicaris.

Limestone rocks of Kota Glanggi.

This is remarkable for its long narrow leaves and short stems. The flower resembles that of *S. Calceolus*, Lindl.

S. caligaris, n. sp. Ferme acaulis. Folia atro-viridia, lorata, falcata, acuta, apicibus inæqualiter bilobis, valde inæqualia, 3–5 pollices longa, ¾ pollicem lata. Racemi breves, ½-pollicares, graciles, pauciflori, rhachide tereti, haud incrassata. Bracteæ ovatæ acutæ, breves. Flores pollicem lati, explanati, pulchri, fugaces. Sepala lanceolata acuta. Petala subspathulata, angustiora, flavescenti-alba. Labellum unguiculatum, unguicula longa, angusta, linearis, virescens, rubro-punctata, lamina carnosa, lobis lateralibus linearibus suberectis obtusis rubris, lobo medio calceolato apice rotundato, callo medio retuso, albo, maculis flavis ad basin lobi medii. Columna apice lato, pallide viridis, crassiuscula. Anthera apice conica, margine elongato rostrato, flava. Pollinia elliptica, dorso canaliculato, pedicello lato triangulari-spathulato, albo, disco triangulari, flavo. Rostellum bifidum, lobis acutis. Capsula longissima, 4 pollices longa, perianthio marcido tecta.

Kwala Pahang, on trees.

This is not a very rare plant in Singapore; it is to be found generally on trees in thick jungle, but never high up. I have seen a liane hanging from a tree in the dense woods of Bukit Timah garlanded with it. The stems are usually about an inch long; the leaves, which are very unequal, are arranged in one plane; the flowers are pretty, but very fugacious.

PHALÆNOPSIS MUSCICOLA, n. sp. Caules breves, radicibus elongatis, viridibus. Folia atro-viridia, 3–4, oblanceolata, oblonga, obtusa, carinata, 6 pollices longa, 2 pollices lata. Scapus elongatus, pluriflorus, ramosus, pedalis, gracilis. Racemi 1½-pollicares, rhachidibus flexuosis teretibus. Flores inter minores plures, dissiti. Bracteæ ovatæ, acutæ, ⅛-pollicares. Sepala angusta, lanceolata acuta, ½-pollicaria, ¼ pollicem lata. Petala subspathulata, acuta, omnia alba, rufo-castaneo-maculata. Labellum carnosum, lobis lateralibus quadrangulatis, dentiformibus, facie interiore excavata, flavescentibus castaneo maculatis, carina media rufescente, callo in disco brevi oblongo-bicornuto, et lingua parva, lanceolata obtusa, integra ad basin lobi medii, lobus medius angustus, linguiformis, roseus, apice decurvo. Columna erecta, ¼-pollicaris. Anthera pileata, obtusa. Capsula linearis, 3-pollicaris, perianthio marcido terminata, ferme ¼ pollicem crassa, pedicello ½-pollicari.

On wet mossy trees far up the Tahan River. Numerous plants were growing here, but I obtained only one flower. I brought home a number of living plants, but owing to the carelessness of a coolie all perished. The species is allied to *P. sumatrana*, Reichb. f., quite distinct in its much smaller flowers and narrower sepals and petals, and in the structure of the lip. It is of no cultural value. The flowers are about as large as those of *P. cornucervi*, Lindl.

P. ALBOVIOLACEA, n. sp. Caules breves, pollicares, radicibus pluribus, planis, griseis. Folia 2–3, oblanceolata, lorata, atro-viridia, tenuiter coriacea, apicibus inæqualiter bilobis, 6 pollices longa, 2 pollices lata. Panicula gracilis, 7-pollicaris, ramis paucis, rhachide atro-viridi versus apicem incrassata. Flores pauci, pro genere parvi, ¾ pollicem lati. Bracteæ minimæ, ovatæ, virides. Pedicelli cum ovariis ½-pollicares. Sepalum posticum oblongum acutum, lateralia latiora et longiora, obtusa, curva. Petala similia, minora, omnia alba, apicibus virescentibus. Labellum trilobum, lobis lateralibus erectis, obovato-cuneatis, apicibus latis obtusis, rotundatis, albis, striis violaceo-roseis; lobo medio obcordato, retuso, violaceo-roseo, marginibus pallidioribus; callus bicornutus, albus, inter lobos laterales; basis labelli depressa, calcar, ore magno, formans. Columna curva, rosea. Anthera parva, alba, rostrata, rostro truncato. Pollinia parva, globosa, pallide flava; pedicello curvo, basi latiore, apice angustato; disco ovali.

Pulau Tiuman (*coll. W. Nanson*); also obtained in the Lankawi Islands by C. Curtis. A curious little plant resembling a *Josephia* at first sight. It has the smallest flowers of any species in the genus, and is allied to *P. Esmeralda*, Reichb. f., a native of the northern part of the Peninsula.

Trichoglottis retusa, Bl.

Top of caves, Kota Glanggi. Also in a similar locality on the limestone rocks at Kwala Lumpur in Selangor.

Saccolabium calceolare, Lindl.

Caves, Kota Glanggi, on the limestone rocks.

S. (§ Speciosæ) saxicolum, n. sp. Caulis elongatus, gracilis, ultra-pedalis. Folia linearia, obtusa, apice bilobo, lobis subæqualibus, coriacea, 3 pollices longa, ¼ pollicem lata, vaginis pollicaribus siccis costatis. Racemus quam folia brevior, ferme bipollicaris, compactus, basi (bracteis ovatis cymbiformibus exceptis) nuda. Flores iis *S. citrini* æquales, bracteis lanceolatis, ¼ pedicelli æqualibus. Sepalum posticum lanceolatum obtusum, lateralia ovata, obliqua. Petala lanceolata, subfalcata, acuta. Labellum lobis lateralibus latis, rotundatis, medio minuto rotundato; calcar ferme rectum, apice curvo, callo parvo curvo in fauce. Columna brevis, crassa, stelidiis longis, porrectis. Anthera longa, rostrata.

Kota Glanggi, limestone caves.

I procured only one specimen of this, and it was dried before I examined it, so that I cannot describe the colour.

Acriopsis javanica, Reinwardt.

Kwala Pahang. Common on orchard trees. I found it also growing upon the ground in tufts of grass at Kwala Pahang on the sea-shore.

A. purpurea, sp. n. (See Appendix, p. 406.)

Thecostele maculosa, n. sp. Epiphytica, pseudobulbis pluribus congestis, conicis, olivaceis, sulcatis, adultis 4-pollicaribus (siccis flavescenti-brunneis), vaginis fibrosis tectis. Folium singulum, petiolatum lanceolatum oblongum, 12 pollices longum, 3 pollices latum, atro-viride nitidum, subtus pallidius, carina prominente. Scapus lateralis pendulus, ferme omnino floribus tectus, 12–18-pollicaris. Racemus laxus, flores parvuli, rhachide crassiuscula. Bracteæ parvæ, ovatæ, persistentes. Pedicelli breves, crassi. Sepalum posticum oblongum subacutum; lateralia latiora, late oblonga, obliqua, subacuta. Petala angusta, lanceolata acuminata, falcata, omnia flavescentia, maculis castaneo-purpureis. Labellum tubo crasso, recto, lamina subpandurata, apice retuso, sepalis brevius, pubescens; lobi laterales breves, curvi, rotundati, albi, macula hippocrepica atro-rosea in medio. Columna gracilis, curva, semiteres, pallide violacea, brachiis linearibus, loratis, curvis obtusis. Anthera plana, flavescens. Pollinia 2, parva, globosa, pedicellis brevibus, disco magno quadrato.

On a tree at Kwala Tahan, also occurring in Penang, Perak, and Kedah.

I cannot see how "*Collabium Wrayii*," Hook. f., Fl. Brit. Ind. vol. vi. p. 784, differs generically from *Thecostele*.

I once received a living plant of *Collabium nebulosum*, Blume, the type of the genus, from Buitenzorg Gardens, which probably was correctly named. It died without flowering, but it was entirely different in appearance from any *Thecostele*, resembling a *Plocoglottis*, and was indisputably terrestrial.

I have no doubt that the affinity of *Thecostele* is with *Acriopsis*. In the latter genus the sides of the claws of the lip are adnate to the base of the column, forming with it a tube, which answers the function of a nectary. If the lower part of the tube be bent on itself so that the nectary is in the plane of the lip and not parallel to the column (*i.e.* at right angles to the normal position of the lip), we shall have what obtains in *Thecostele*. The remainder of the structure of the column is that of *Acriopsis*, and I therefore conclude that *Thecostele* belongs to the section *Notylieæ* of Vandeæ.

T. maculosa is very nearly allied to *T. alata*, Reichb. f., but differs in the shape of the pseudobulbs, which are much longer and conical, in the narrower petioled leaves, and in the shape of the mid-lobe of the lip.

PODOCHILUS ACICULARIS, Hook. f.
On low trees in thick jungle. Tahan River.

P. MICROPHYLLUS, Lindl.
Common on trees, Tahan River.

P. UNCIFERUS, Hook. f.

APPENDICULA BIFARIA, Lindl.
On wet mossy trees, Tahan Valley. A larger form than usual.

A. CALLOSA, Blume.
Trees, Tahan Valley.

A. MAINGAYII, Hook. f.
Growing plentifully on rocks on the banks of the Tahan. A tufted plant with very many stems arising from a stout woody rhizome with copious roots. Flowers white, with a pink lip.

A. ELONGATA, n. sp. Caules longi, penduli, ultra tripedales, compressi. Folia approximata, oblonga, obtusa, basibus latioribus, apicibus rotundatis, bilobis, ¾ pollicem longa, ⅜ pollicem lata ; vagina ¼-pollicaris, ore obliquo. Flores congesti in apicibus caulium, parvi, albi. Sepala ovata, subacuta, lateralia latiora. Petala lorata, subobtusa, parva. Labellum sigmoideum, trilobum, carnosulum, obtusum, nec unguiculatum nec ad basin calceolatum, lateribus erectis columnæ adnatis, lobis lateralibus rotundatis, lobo medio longiore, margine crispo, concavo. Columna brevis, brachiis longis erectis loratis, iis *A. bifariæ*, Lindl., similibus. Capsula sessilis, ¼-pollicaris, oblonga, costis linearibus elevatis.

On trees overhanging the Tahan River.

This plant is very similar to *A. callosa*, but is very much larger, with a very different lip.

THELASIS ELONGATA, Blume.
Tahan River, on trees.

THELASIS CAPITATA, Blume.
Pekan, at Pramau.

T. ELATA, Hook. f.
Kota Glanggi, Kwala Pahang.

T. DECURVA, Hook. f.
Tahan River.

NEOTTIACEÆ.

VANILLA, sp.
Pekan. In fruit only.

This is probably the "*Vanilla albida*, Blume," of the 'Flora of British India,' but not of Blume. It is quite common in the Malay Peninsula, but rarely flowers. It is entirely distinct from the plant figured by Blume.

I will describe it here under the name of

V. TOLYPEPHORA, n. sp. (τολύπη, a ball of wool.) Scandens, caulibus elongatis, crassis, canaliculatis, viridibus, radicibus longis gracilibus. Folia ovata vel ovato-lanceolata acuta, 6 pollices longa, 3 pollices lata, viridia, obscure reticulata. Flores in racemo plures singulatim expansi, magni, odori; alabastra clavata. Sepala ovata, ultra-pollicaria, virescenti-alba. Petala obovata, subobtusa, majora. Labellum explanatum, trilobum, lobi laterales lati, rotundati, albi, dente parvo terminali, discus profunde excavatus, nervis latis, elevatis, castaneo-kermesinis in utroque latere; lobus medius bilobus flabellatus, latus, albus, callo globoso lanuginoso albo in medio. Columna alba, crassa, paullo curva. Stelidia lata, obscure flabellulata. Anthera pendula, filamento validulo, oblonga ovata, subacuta, bilocularis, ochrea. Rostellum latum, planum, integrum, margine recto. Stigma transversim lineare.

This occurs in Penang and in an island called Pulau Ubin, lying in the strait between Singapore and Johore, where it covers the bushes with a thick mat of stems, and in Selangor, and is, I believe, the common species all over the Peninsula, but it very seldom produces flowers. The flowers are as beautiful as any in the genus, and the fruit, like small bananas, is quite sweet and eatable.

The *Vanilla albida*, Blume, according to the figure in 'Rumphia,' differs in its lanceolate-acuminate leaves, narrower sepals and petals, and convolute lip, with the lateral lobes hardly distinct, and with a broad raised bar down the centre of the lip, terminated by a tuft of white hairs in the notch of the terminal lobe.

In *V. tolypephora* the lip is very broad and spread open; there is a deep wide channel down the disc between the lateral lobes, on each side of which are three raised, curved, brown-crimson ribs; the terminal lobe, beautifully plicate, forms an angle with the rest of the lip, and bears a woolly ball, which nearly covers the central portion of this lobe.

CYSTORCHIS VARIEGATA, Blume.
Tahan woods.

C. JAVANICA, Blume.
With the last, with which it is too closely allied to be, I think, specifically distinct;

except for the leaves being dark purple, the flowers a little longer and narrower, and the spur slenderer, I cannot see any difference.

Pogonia ? striata, n. sp. Rhizoma haud visum. Caulis ferme 3-pedalis, succulenta, alba, striis violaceis, vaginis pluribus ad basin caulis. Folia nulla. Racemus terminalis laxus, floribus circiter 12. Bracteæ reflexæ, albæ, striis violaceis, lanceolatæ, ½-pollicares. Flores circiter ½-pollicares, vix aperti, pedicellis ¾-pollicaribus, gracilibus, albis, striis violaceis, ovario haud distincto. Sepala lanceolata acuta. Petala similia, alba, striis violaceis. Labellum integrum, petalis et sepalis simile, marginibus ad basin involutis, album, stria purpurea ad basin. Columna gracilis, paullo curva, ad apicem incrassata alba, basi violacea, apice flavo, clinandrium haud profundum. Anthera magna, crassa, pileata, apice obtuso, basi abrupte dilatata, loculis disjunctis, flava. Pollinia pulverulenta 2. Rostellum elongatum, linguiforme, erectum, integrum, obtusum. Stigma angustum, lineare, margine inferiore producto.

A single specimen was brought to me by the men, in the Tahan woods. It is a very remarkable plant and evidently saprophytic. Owing to the difficulties of the march on that day, I was unable to examine the pollinia satisfactorily in the live plant, and they have not preserved well owing to the succulence of the plant.

It appears to be most closely allied to *Pogonia*, under which genus I have provisionally placed it, but it will probably prove generically distinct.

P. flabellata, Blume ?

Leaves only seen ; large and fan-shaped, with black markings in the centre. Woods, Kwala Tembeling.

Aphyllorchis pallida, Blume.

A single plant, in the Tahan woods, near Kwala Tenok. The flowers were yellow, with violet spots.

Hæmaria discolor, Lindl.

Pulau Tiuman, on rocks in streams, both the common form and the var. *ordiana* with green leaves.

Lecanorchis malaccensis, n. sp. (Pl. LXV.) Herba gracilis, rigida, nigra, 6–12-pollicaris, ramosa. Radices elongati, subfusiformes, crassiusculi. Caules tenues, vaginis paucis dissitis ovatis. Folia evoluta nulla. Flores racemosi vel paniculati, pauci, fugacissimi, erecti, pollicares, ovarium gracile rectum, cupula denticulata terminali. Sepala lanceolato-spathulata, pallide carnea vel flavescenti-alba. Petala æquilonga, pallida, omnia conniventia, tenuia. Labellum pro majore parte adnatum ad basin columnæ, sepalis æquilongum, portio libera spathulata dense barbata flava, carinis duabus vix elevatis e basi labelli exortis versus apicem attenuatis. Columna gracilis, superne dilatata, recta, margine clinandrii obscure sinuato. Rostellum nullum. Anthera crassa, obtusa, truncata, apice clinandrio affixa bilocularis, violascens. Pollinia 2, oblonga, canaliculata. Stigmatis fovea majuscula, stigmate subgloboso, glutinoso in basin. Capsula longa, angusta, cupula terminata nigra.

Tahan woods, not rare. This plant occurs also in many woods of Singapore, Malacca, Penang, and Kedah. It is a very difficult plant to see in the dense jungles, as its black wiry stems are very inconspicuous. The flowers are very perishable, of a pale flesh-colour, like those of *Didymoplexis pallens*, Griff. They are self-fertilized, the rostellum and floor of the clinandrium being suppressed; the pollen-masses, even before the flower opens, fall forward over the stigmatic surface at the base of the large fovea, and eventually become agglutinated to it. The capsule splits for its whole length, except that the ribs remain connate at the base and apex.

There are two other species of this remarkable genus described by Blume. The Malay Peninsula one, curiously, seems more nearly allied to *L. japonica*, Blume, than to *L. javanica*, Blume.

APOSTASIACEÆ.

APOSTASIA NUDA, R. Br.

Woods at Kota Glanggi and on the Tahan River.

SCITAMINEÆ.

ZINGIBERACEÆ.

GLOBBA VARIABILIS, n. sp. Cæspitosa. Caules paullo ultra-pedales, graciles, nutantes. Folia ovata vel ovato-lanceolata acuminata, 4 pollices longa, 1½ lata, lamina omnino glabra, supra atro-viridis, striolata, subtus purpurea, carina viridi; vaginæ pubescentes, uno latere profunde fissæ, virides, purpurascentes. Pedunculi terminales, nutantes, 4–5-pollicares, paniculæ compactæ, ramis brevibus. Bracteæ ⅜-pollicares, oblongæ lanceolatæ, aurantiacæ aut coccineæ, persistentes. Bracteolæ minores. Calyx sepalis oblongis acutis, aurantiacis. Corollæ tubus gracilis, superne dilatatus, minute pubescens, lobis oblongis lanceolatis deflexis, postico cymbiformi erecto. Labellum oblongum cuneatum, lobis obtusis, truncatis, ¼-pollicaribus, aurantiacum, macula mediana castanea. Staminodia oblonga, lanceolata, petalis breviora. Staminis filamentum ¾-pollicare, semiteres. Anthera 4-calcarata, calcaribus acutis, supremis longioribus. Stylus gracillimus. Capsula parva, subglobosa, rugulosa.

Very abundant in the woods around Kota Glanggi and at Pulau Tawar, and also in the Tahan region. The bracts vary from orange-yellow to red, giving the different forms quite dissimilar appearances.

The species is allied to *G. Schomburgkii*, Hook., but has a much more compact panicle. Like all other *Globbas*, it will, in wet places, produce bulbils in the axils of the bracts.

CURCUMA SYLVESTRIS, n. sp. Rhizoma vix aromaticum, gracile, vaginis siccis tectum, pro majore parte subterraneum. Folia singula floribus coætanea, vagina 2–4-pollicari, petiolum et scapum basi involvente. Petiolus gracilis, 1–1½-pedalis; lamina 8 pollices longa, 4½ pollices lata, tenui, ovata acuta, supra viridi, subtus purpurascente. Scapus 4–6-pollicaris, gracilis, spica obconica 1½-pollicari. Bracteæ late ovatæ, striatæ, apicibus recurvis, roseæ. Flores breviter exserti, parvi. Corollæ tubus

½-pollicaris, albus, gracilis, lobi angusti lineares acuti, ½-pollicares. Staminodia latiora, lorata, obtusa, alba. Labellum oblongum obovatum, apice emarginato, lobis rotundatis albis, macula flava mediana, striis violaceis in lobis. Stamen filamento latiusculo. Anthera oblonga, connectivo lato, recurvo obtuso, atro-violaceo. Loculi angusti lineares. Pollen pallidum flavum. Capsula non visa.

Abundant in the Tahan woods, but seldom flowering. This is a pretty small species, and the only Turmeric known to me from the Peninsula which has the flower-spike distinct from the leaves. The only other wild species I have seen from the Peninsula is *C. petiolata*, Rosc., common in open country, generally, however, near old cultivation; *C. grandiflora*, Wall., is also described "from the Malay Peninsula," and I have received *C. parviflora*, Wall., from Bangtaphan in Siam, sent by Dr. Keith. All these belong to the section *Hitcheniopsis*.

COSTUS SPECIOSUS, Linn.

Common. Tahan woods.

There are two forms of this plant which have a very distinct appearance. The common form has stout stems and big heads of flowers, with a very large lip, white, with a yellow central spot. This is met with in open swampy spots, on borders of rivers, &c. The petals are often tinted with rose, which tint, with the narrower leaves, apparently alone constitutes the distinction of *C. nipalensis*, Rosc. (*C. speciosa angustifolia*, Hook.). The other form has slenderer, more straggling, often branched stems, smaller heads of flowers, and smaller flowers, without any yellow on the lip. It has the habit somewhat of the next species, and frequents damp rocky woods. I have gathered both forms in the Tahan Valley woods.

C. GLOBOSUS, Blume.

Tahan woods, banks of the river.

This is quite distinct from *C. speciosus*. The racemes are not terminal, but almost buried in the ground, on short stems; the calyces are quite prickly, the flowers yellow and red. It is much scarcer than the preceding, though I have had it from Penang and other parts of the Peninsula, and from Singapore.

GASTROCHILUS BILOBA, n. sp. Perennis, acaulis. Folia oblonga obtusa, petiolata; lamina 6–8-pollicaris, 3–3½ pollices lata, supra glabra atro-viridis, fasciis pallidioribus, subtus purpurea, nervis elevatis, costa crassa pubescente; petiolus crassus, 2–3-pollicaris, canaliculatus, pubescens. Racemi breves laterales folio approximati, pollicares, sessiles, bracteis pluribus latis ad basin. Bracteæ atro-rubræ. Flores plures, singulatim expansi, mox caduci, bracteolis binis tenuibus lanceolatis, striatis, rufis. Calyx semipollicaris, tubulosus, quam bracteæ brevior, superne dilatatus, ore intus profunde emarginato, pallidus, transversim rubro-venosus, laciniis obscuris obtusis. Corollæ tubus 1¼-pollicaris, gracilis, albus, lobis reflexis lanceolatis acutis, ¾ pollicem longis, ¼ pollicem latis, albis. Staminodia magis oblonga, ½ pollicem longa, obtusa, alba. Labellum oblongum, patulum, bilobum, lobis imbricatis rotundatis obtusis, ferme pollicaribus, ¾ pollicem latis, medio canaliculato, nervis lateralibus paullo elevatis, album, basi roseo-tincta. Anthera lata oblonga, alba, loculis pallide aurantiacis angustis, canaliculo medio profundo; connectivo majusculo erecto, rotundato ovato subacuto. Stylus gracilis, albus, apice incrassato rostrato.

Woods at Kwala Tahan.

This plant is allied to *Gastrochilus longiflora*, Wall., but differs in the bilobed lip, which is not saccate as in Wallich's figure, and the staminodes shorter than the petals.

Zingiber spectabile, Griff.

Common near Pulau Kinchi, Temerloh, Pulau Tawar, Kota Glanggi woods, and Tahan River woods.

This is a very noble plant, the large red spikes suggesting those of *Tapeinocheilos*. The flowers are light yellow, reticulately veined with black. It is common in many parts of the Peninsula.

Z. gracile, Jack.

Common. Kwala Tembeling. A form with a very long peduncle to the spike.

Z. Griffithii, Baker.

Woods, Pulau Tawar.

Z., sp.

I found another Ginger growing in a stream in a very wet place in the Tahan woods, which had spikes like those of *Z. gracile*, borne on the ends of long, weak, leafy stems. The flowers were not opened.

Kæmpferia parvula, King.

Common on the banks of the Tahan River.

This charming little plant is very different in appearance from other Kæmpferias, and I think will prove generically distinct. It is abundant on stream-banks at about 1000 feet altitude and above, on the top of Penang Hill, and at Thaiping in the Larut Hills.

Alpinia conchigera, Griff.

A common plant in open sandy country, generally growing near or in water. It forms small thickets about three feet high, and is called by the natives "Langkwas Pranting" (twiggy *Alpinia*).

Common on the heaths at Kwala Pahang and Rumpin.

A. mutica, Roxb.

Pekan, and many places along the river-banks below this. In dense waterside thickets, also, Kwala Berar.

A. malaccensis, Roxb.

Pulau Datoh, and other islets in the Pahang River. A very big, showy plant.

An *Alpinia* with much more hairy fruits, found at Kwala Tembeling in dense thickets along the river-bank, may be distinct.

Amomum megalocheilus, Baker. (*Achasma megalocheilus*, Griff.)

Common. Tahang woods, Pekan, Tanjong Gajah Mati, Pahang River. This is a tolerably common plant, forming dense brakes on the river-banks.

Amomum scyphiferum, Koen. (*Hornstedtia Scyphus*, Retz.; *Stenochasma urceolare*, Griff.)

Not rare along the Pahang River, in woods, and Tahan River.

A. Leonurus, Koen. (*Stenochasma convoluta*, Griff.)

Pulau Tawar woods.

A. Ophiuchus, n. sp. Caules foliati exaltati, circiter 12-pedales, basi clavati. Folia oblongo-lanceolata, glabra, acuminata, costa elevata, nervis plurimis, tenuibus, $1\frac{1}{2}$-pedalia, 3 pollices lata, petiolo $\frac{1}{2}$-pollicari, vaginis ad basin fissis, striatis, costatis, ligula ovata oblonga obtusa, pubescente. Spica fusiformis, 5-pollicaris, sessilis, bracteis pluribus ad basin vacuis. Bracteæ florales ovatæ vel ovatæ lanceolatæ acutæ, mucronatæ, costatæ, sericeo-pubescentes, nervis transversis nullis, 2 pollices longæ, 1 pollicem latæ, rubræ. Flores plurimi 1–2 singulatim expansi, rubri, aperti, vix bracteas superantes, marcescentes multo longiores, 5-pollicares. Calyx spathacea, tubulosa, 3-pollicaris, acuta, angusta, superne glabra, basi sericea. Corolla tubo gracili rubro, petala lorata, cucullata, lucida, rubra. Labellum æquilongum, loratum, apice calceolato, carnosulum, rubrum, marginibus albis, intus pubescens. Anthera pubescens, oblonga, apice emarginato, roseo, pubescente, ecristata. Pollen album. Stylus gracilis, stigmate clavato, pubescens. Ovarium oblongum, sericeum.

Tahan woods.

Allied to *A scyphiferum*, Koen., but with glabrous leaves, narrower acute bracts, with no cross-veins, a fusiform spike, &c. The leafy stems are swollen at the base into a club-shape; and the flowers when fully open hardly project beyond the spike, but when withered they become elongate and curve over and hang down.

A. laterale, n. sp. Herba magna, rhizomate crasso subterraneo. Caules foliati, tripedales. Folia lanceolata acuminata, acumine longo, undique (præsertim in dorso) pubescentia, lamina $2\frac{1}{2}$-pedalis circiter 4 pollices longa, carina validula; basi in petiolo pollicari angustata; ligula biloba obtusa, $\frac{1}{4}$-pollicaris. Spica cylindrica magna, 6-pollicaris, crassa, densa, e caule foliato extrusa, pedunculo crasso, 2-pollicaris. Bracteæ suboblongæ, apicibus laciniatis. Flores arcte congesti, plurimi, parvi, carnosuli, $\frac{1}{2}$-pollicares. Calyx conicus spathaceus, tubo columnæ æquali, albo. Petala ovata acuta, carnosa, atro-rubentia. Labellum breve, unguiculatum, lamina deflexa, aurantiaca, emarginata, obtusa, in medio callosula. Stamen filamento brevi, albo, pubescente. Anthera oblonga, pubescens, apice emarginato, exappendiculato. Stigma rotundatum decurvum. Capsula ovoideo-conica, $\frac{1}{2}$-pollicaris, tenuis, sicca pallide brunnea, loculis tribus, semina 3–4 in utroque loculo, fusca, angulata.

Woods, Pulau Tawar. I have also gathered this in Singapore.

The habit of this plant is that of one of the *Hornstedtia* section of *Amomum*. It is remarkable for its inflorescence being lateral and the small fleshy flowers imbedded in pectinate bracts. I am inclined to think it should form the type of a new genus.

A. aculeatum, Roxb.

Not rare. Pengkalang Kasai, Kwala Tembeling, Kota Glanggi woods. It is called "Toopoos Merah."

Elettariopsis longituba, n. sp. Folia plura (ad 5), petiolis ad 9 pollices longis, laminis lanceolatis ad basin attenuatis, apicibus acutis, 12–16 pollices longis, 2–4 pollices latis, glabris. Panicula decumbens, bipedalis vel longior, vaginis laxis 1½-pollicaribus mucronulatis tecta, spicæ secundæ plures breves, paucifloræ, pedunculis ½-pollicaribus erectis. Bracteæ lanceolatæ, spathaceæ, acutæ, 1½-pollicares, flores duos involventes. Flos breviter (¼ pollicem) pedicellatus. Calycis tubus bipollicaris, gracilis, superne dilatatus, lamina ovato-spathacea, apice tridentata, dente medio quam exteriores breviore. Corollæ tubus ¼ pollicem longior quam calycis, laciniis oblongis obtusis, firmis, apicibus cucullatis, roseis, translucentibus, pollicem longis, ¼ pollicem latis. Labellum convolutum obovatum, margine crenulato, tenue, 1¼ pollices longum, album, lineis 4 roseis medianis, versus apicem flavum. Anthera brevis, ¼ pollicem longa, oblonga, appendice cristato recurvo, dentibus 4, filamentum gracile ad apicem pubescens. Stylus validulus, quam anthera brevior. Stigma clavatum, apice plano, fovea laterali ovoidea. Capsula globosa, alba, breviter apiculata, pollicem crassa. Semina plura parva triangularia, compressa, nigra.

In dense, rocky, wet jungle, Tahan River, also at Bukit Timah in Singapore.

This curious plant emits long slender rhizomes creeping far among the rotten timber and wet leaves almost underground. In the Tahan woods it was so mixed up with other Scitamineæ that the leaves of an *Amomum* were collected by mistake for its own, and have been thus distributed to various herbaria.

MARANTACEÆ.

Clinogyne grandis, Benth.

In the Tahan woods; not rare. This fine Arrowroot is very common in most parts of the Peninsula.

Another form which I met with in the Tahan woods differed in being smaller in all its parts, and has less polished fruits, containing two seeds each instead of one. It may prove a distinct species.

C. dichotoma, Benth.

A much smaller plant, forming thickets in damp fields and along the river-banks; very common on the Pahang and Tembeling Rivers.

Phrynium parviflorum, Roxb.

Common in thickets and dry woods near Pekan, and at Kwala Tembeling and Tahan River. It differs in colour here a little from Roxburgh's description.

P. Griffithii, Baker. (*P. spicatum*, Griff., *non* Roxburgh.)

Woods of the Tahan River. It is called "Larath" by the natives. This fine plant forms huge tufts in wet places, and is common in Singapore and Malacca also. Its flowers, hidden among the leaves at the base, are very sweetly scented.

P. tapirorum, n. sp. Herba dense cæspitosa, ad sexpedalis. Folia ovata lanceolata, longe petiolata, iis *P. Griffithii* similes, sed haud glauca subtus, lamina 18 pollices longa, 8 pollices lata, acuminata, glabra, nervis plurimis tenuibus. Paniculæ glabræ e petiolis exortæ, pedunculo ferme pedali, validulo, quam folium breviores. Spicæ 2–3 in

pedunculo, patentes, circiter 4-pollicares, bracteis plurimis brunneis, ovato-lanceolatis. Flores breviter pedicellati tres, in bractea magna, pollicem longa, $\frac{3}{4}$ pollicem lata. Bracteolæ 2 tenuiores, bicarinatæ, bifidæ, flores singulos involventes. Sepala linearia subulata, ultra $\frac{1}{2}$-pollicaria. Corolla alba, tubo curvo, superne dilatato, nec tenui; lobis oblongis, apicibus rotundatis obtusis, breviusculis, recurvis. Stamen appendice oblongo. Stylus abrupte recurvus, crassus. Capsula oblonga, obtuse trigona, $\frac{3}{8}$-pollicaris, pedicello $\frac{1}{8}$ pollicem longo, loculis 3, semen in loculo singulum elongatum (haud maturum).

Tahan woods in a damp spot, in dense jungle, forming a thick bed. There were many wild animals here, and what appeared by the tracks to be a tapir had made a pathway through the thickets and eaten the plant.

The habit of this plant is that of *P. Griffithii*, Baker, but it is remarkable for having the spikes panicled on the top of a strong erect peduncle which rises from the petiole. The bloom was nearly over and, as in all these plants, very fugacious, and the fruit was hardly ripe.

LOWIACEÆ.

PROTAMOMUM, n. gen.

Herba cæspitosa, acaulis. Folia disticha petiolata, petiolis ferme pedalibus, lamina lanceolata acuminata, tenuiter coriacea, nervis ferme exacte parallelis, primariis circiter 14. Anthela axillaris, paniculata, decumbens, ramis 2–3, undique bracteis tecta. Flores in ramis singulatim expansi, bini in bracteolis. Bracteolæ 2, inferior oblonga, mucronata, brevis, superior longior, $1\frac{1}{2}$-pollicaris, oblongo-lorata, mucronata, striata, viridis, tubum solidum floris involvens. Sepala 3, linearia, acuminata acuta. Petala 3, sepalis alterna; 2 oblonga, erecta, parallela, mucronata; 1 (labellum) ellipticum obtusum, basi angusta. Stamina 5, petalis alterna, brevia, $\frac{1}{8}$-pollicaria; anthera curva obtusa, loculis 2 parallellis linearibus, tenuibus, longitudinaliter fissis, exappendiculata, apice emarginato recurvo. Pollen granulosum, granulis majusculis globosis. Filamenta validula, basibus incrassatis, connatis. Stylus crassus, basi dilatata, staminibus subæqualis, stigma magnum, postice trilobum, lobis dentatis, antice excavatum. Capsula majuscula, lanceolata acuminata subtrigona, glabra, trilocularis. Semina in loculo tria, serie una, majuscula, lageniformia, brunnea, hispida.

P. MAXILLARIOIDES, n. sp. (Pl. LXVI.) Herba sylvestris. Folia plura disticha, erecta, petiolis pedalibus, majore parte vaginantibus et marginatis, superne teretibus, canaliculo excepto; laminis lanceolatis acuminatis, 8 pollices longis, 3 pollices latis, læte viridibus, fasciis transversis obscurioribus indistinctis, carina præsertim ad basin distincta; nervis primariis circiter 14, parallelis, rectis; secundariis tenuissimis, plurimis nervis transversis, perplurimis tenuibus. Inflorescentia a vagina petiol ad basin inclusa axillaris, 3 pollices longa, ramis 2–3, bracteis arcte involutis. Flores mediocres; sepala $1\frac{1}{4}$ pollices longa, $\frac{1}{2}$ pollicem lata, angusta acuta mucronulata, translucentia, nitida, atro-rubentia, patentia, tubus infra limbum solidus. Petala 3; 2 postica erecta, pistillo æquilonga, oblonga obliqua, mucronulata, valvata, violacea, $\frac{3}{16}$ pollicem longa. Labellum porrectum, unguiculo brevi, atro-purpureo, oblongo, lamina oblonga obtusa, violascenti-alba, maculis violaceis punctata, fascia mediana

lata, linearis, elevata, nervis 4 in utroque latere elevatis sinuatis, margine crispulo. Stamina 5, filamentis brevibus $\frac{1}{8}$-pollicaribus, basi incrassatis, connatis, albis violaceo punctatis; antheræ introrsæ adnatæ, lineares exappendiculatæ. Stylus crassus, albus roseo-tinctus, rectus, antheras superans. Stigma magnum, subcordatum, excavatum marginibus, lobis subfoliaceis denticulatis canaliculatis, violaceum. Capsula magna, fusiformis, rostrata, subtrigona, atro-violacea. Semina $\frac{1}{2}$-pollicaria.

Pulau Tawar woods.

A tufted plant with rather showy purple flowers like those of some *Maxillaria*. It is allied to *Lowia longiflora*, Scort., but is, I think, generically distinct. The leaves are arranged distichously, reminding one of *Ravenala* on a small scale; from the axil of these is emitted the inflorescence. In *Lowia* the inflorescence appears to arise from the rhizome, away from the leaves, which are not thus arranged.

The anthers are appendaged in *Lowia* and acute, and the stigmas are split to the base: "lobis cylindricis, latere fissis, toto margine dentatis."

MUSACEÆ.

MUSA SAPIENTUM, Linn.

The Banana is cultivated extensively by the natives,

Mr. Baker, in the 'Flora of British India,' reduces all the wild Bananas of the section *M. sapientum* to one species, as varieties and subspecies of the cultivated plant. With this I can by no means agree.

I have met with three distinct wild species in the Peninsula. These are:—*M. violascens*, n. sp.; *M. malaccensis*, n. sp.; and *M. flava*, n. sp.

M. VIOLASCENS, n. sp. Caudex teres, gracilis, 8–10-pedalis. Folia subtus glauca, 10 pollices lata, costa crassa. Spadix erecta vel suberecta, $1\frac{1}{2}$-pedalis, apice acuto, rhachide $\frac{1}{2}$ pollicem crassa, lanugine fulva tecta. Bracteæ sæpe diu persistentes, deflexæ, angustæ, lanceolatæ acutæ acuminatæ, albæ purpureo-violaceo tinctæ vel omnino violaceæ, ad 9 pollices longæ, 2 pollices vel ultra latæ. Flores masculi albi, apicibus flavis, $1\frac{1}{2}$ pollices longi, 6 in serie una. Calyx oblongus, apice 5-laciniato, laciniis 2 exterioribus longioribus, linearibus, tortuosis. Petalum $\frac{3}{4}$-pollicare, oblongum obtusum, cymbiforme. Stamina 5, tenuia, alba, loculis antheræ inæqualibus, loratis, linearibus, pallidis. Stylus complanatus, clavato-spathulatus. Flores feminei 6 in bractea utraque in serie una. Stylus crassus, apice complanato, clavato, bipollicari. Bacca viridis 3 pollices longa, pollicem crassa, angulata. Semina $\frac{1}{4}$ pollicem longa, cylindrica, apicibus truncatis, nec angulata.

Pahang, River Tahan, in woods; Selangor, Kwala Lumpur, common; Sungei Ujong, near Linsum.

This plant is distinguished by its erect, or almost erect, spadix, of which the bracts are remarkably long and narrow, acuminate, and of a violet colour like that of a Brinjal. The flowers are few and arranged in single rows in each bract; sometimes the bracts are persistent after the flowers are fallen and hang down. The seeds are cylindrical, and not angled and irregular as in the common Banana and *M. malaccensis*, n. sp.

This species belongs apparently to Baker's section *Rhodochlamys* ('Annals of Botany,' vii. 205), as it has an erect spike and few flowers to a bract; but the petal has the form of that of the *Eu-musa* section.

MUSA MALACCENSIS, n. sp. Caules pauci, 1–2, ad 10-pedales, graciles, 6 pollices crassi, brunneo-purpureo marmorati. Folia circiter 8-pedalia, viridia, sæpe (præsertim juvenia) striis brunneis ornata, petiolo canaliculato et margine alato, crasso, lamina 13 pollices lata. Spadix pendula, rhachide pollicem crassa, viridi, lanugine brunnea tecta. Bracteæ lanceolatæ subacutæ, crassæ, reflexæ, convolutæ, brunneæ, extus glaucescentes, intus flavescentes striatæ. Flores masculi $1\frac{1}{2}$ pollices longi, curvi, albi. Calyx cymbiformis, carinatus, dentibus 5 linearibus recurvis, subacutis, flavis. Petalum oblongum, album, mucronatum, $\frac{3}{4}$ pollicem longum, $\frac{1}{2}$ pollicem latum. Stamina 5, $1\frac{1}{8}$ pollices longa, filamentis complanatis. Antheræ oblongæ angustæ, apicibus retusis, loculis angustis disjunctis, connectivo lato. Stylus $1\frac{1}{8}$ pollices longus, antheris subæqualis. Stigma (abortivum) ochreum, subclavatum. Flores feminei 16 in bractea utraque in seriebus duabus. Ovarium pallide viride, $1\frac{3}{4}$ pollices longum, $\frac{3}{8}$ pollicem latum, lateraliter compressum, quinquangulare, lateribus valde inæqualibus. Calyx pollicaris, $\frac{1}{4}$ pollicem latus, apice recurvo 5-dentato, dentibus linearibus subæqualibus, albescens, lineis fuscis 2 in dorso. Petalum $\frac{3}{4}$ pollicem longum, translucens, cymbiforme, $\frac{5}{8}$ pollicem latum, ovatum acuminatum. Stamina subæqualia, $\frac{1}{2}$ pollicem longa, complanata, linearia acuta, apicibus nigris. Stylus crassus, pollicaris, teres, minute pubescens, striatus, albus. Stigma $\frac{1}{8}$ pollicem longum, crassum, conicum, fuscum, obtusum. Bacca subcylindrica subtrigona curva, 4 pollices longa, pollicem lata. Semina nigra, angulata, irregularia.

This is common in the jungles of Malacca, Selangor, and Perak, occurring also in Pahang at Tanjong Gajah Mati. It is the "Pisang karok" of the Malays.

M. zebrina ('Flore des Serres,' t. 1061, 1062) is doubtless a young plant either of this species or of *M. sumatrana*, Becc. I never saw any form of *M. sapientum*, L. (to which species Mr. Baker refers this), with barred leaves. The brown bars are very constant in young plants of *M. malaccensis*, and even persist sometimes in the adult foliage. This species may perhaps be the parent of some of the cultivated Bananas here, but is very distinct from *M. sapientum* in the hairy rhachis and other points.

An attempt has been made to utilize the fibre, but it is apparently not so good as that of *M. textilis*; still, as it is not only very abundant throughout the centre of the Peninsula, but also springs up like a weed in many places when old jungle is felled, and forms an impenetrable thicket, it will probably be found to be well worth extracting the fibre.

M. FLAVA, n. sp. Folia 16 pollices lata, viridia, nervis quam in præcedente paucioribus. Spadix nutans, pedunculo valido subflexuoso, pubescentia castanea tecto. Bracteæ late ovato-lanceolatæ obtusæ, 4 pollices longæ, $1\frac{1}{2}$ pollices latæ, flavæ, intus striatæ. Flores masculi 16 in seriebus duabus breviter pedicellatis. Calyx $1\frac{1}{2}$ pollices longus, dorso bicarinato, laciniis 5 æqualibus recurvis. Petalum $\frac{3}{4}$ pollicem oblongum mucronatum, $\frac{1}{4}$ pollicem latum, striatum. Stamina ut *Musa malaccensis*, connectivo crasso, loculis tenuibus. Stylus tenuis, staminibus brevior. Stigma conicum acutum, complanatum, uncatum. Flores feminei 16 in utraque bractea in seriebus duabus. Bacca circiter 2-pollicaris (ex sicco), rostrata, pedicellata, 5-angulata.

Pahang, at Pulau Tijau on the Pahang River.

Only one specimen of this species was found, and portions brought into camp by the collectors. The female flowers were too far advanced to examine, and I did not see the whole plant, so the description is somewhat incomplete. It is nearly allied to *M. malaccensis*, but the broad, thick, blunt, bright yellow bracts give it a totally different appearance, the spadix being quite blunt at the top.

TACCACEÆ.

TACCA PINNATIFIDA, Forst.

Sea-shores, Cherating and Kwala Pahang.

T. CRISTATA, Jack.

Woods at Pramau, near Pekan, and Kota Glanggi.

DIOSCOREACEÆ.

DIOSCOREA DÆMONA, Roxb.

Telor Malaki, and other places on the Pahang River. Common around villages.

This is not a "tropical forest" plant here, as the 'Flora of British India' suggests. I have never seen it except close to the villages. It is known as "Ubi Gadong." The yams can be eaten if they are cut up and plunged in running water for about twenty-four hours, otherwise they are poisonous. Their juice is used by some of the wild tribes to mix with the Ipoh, arrow-poison (*Antiaris toxicaria*).

D. PENTAPHYLLA, Linn.?

A yam with axillary bulbils found at Kwala Tahan may perhaps be this. There were no flowers.

TRICHOPUS ZEYLANICUS, Gaertn.

Abundant round the caves of Kota Glanggi. Not hitherto recorded from the Peninsula.

ROXBURGHIACEÆ.

STEMONA TUBEROSA, Lour. (*S. Curtisii*, Hook. f.)

Common in thickets. Kwala Luit, Kota Glanggi, Pulau Chengei, on the Pahang River.

I have little doubt that Loureiro was describing the Malay Peninsula plant when he wrote his description of *Stemona tuberosa*. It is quite different from *S. gloriosoides*, Voigt, the Indian plant, which is described and figured with the leaves tapering into the petiole (and not cordate emarginate), and the flowers large and green (not brown), and such as they are in the Malay Peninsula plant. Kunth's *Roxburghia javanica* (Enum. Pl. v. p. 288) may be the same.

HÆMODORACEÆ.

PELIOSANTHES ALBIDA, Baker.

Tahan woods.

There are also several others in the collection which I cannot match with any described in the 'Flora of British India.' Most came from the thick woods on the banks of the Tahan.

AMARYLLIDEÆ.

HYPOXIS AUREA, Lour.

Meadows at Blay Manis, Pahang River.

This has not been recorded previously from the Malay Peninsula. I have, however, also received it from Bangtaphan in Siam.

CURCULIGO LATIFOLIA, Dryand.

Common in the woods at Pekan and Kota Glanggi.

I do not know whether the curious property of the fruit of this plant is anywhere recorded. It is very succulent and has a taste of sweet cucumbers; but after eating one or two everything eaten or drunk tastes almost unbearably sweet, the effect lasting for some hours.

CRINUM ASIATICUM, Linn.

Common on the sea-shore and for some way up the Pahang River.

C. ENSIFOLIUM, Roxb. ?

In open pastures at Kwala Mahang, and up the river as far as Temerloh.

I am by no means certain of the correctness of this identification, but it seems nearer to this species than to any other in the 'Flora of British India.'

EURYCLES AMBOINENSIS, Salisb.

In sandy places near villages at Kwala Pahang. Not in flower. This is not recorded from the Peninsula in the 'Flora of British India.' I have no doubt but that it is native. It occurs scantily in sandy places near the shores in various parts of the Peninsula, but very seldom flowers.

LILIACEÆ.

SMILAX CALOPHYLLA, Wall.

Woods, Pulau Tawar and Tahan River.

S. HELFERI, A. DC.

Very common in thickets in open country, all along the Pahang River (*e.g.* at Kalambalai, Kwala Mahang, and Temerloh), also in Kelantan at Kamposa.

DRACÆNA TERNIFLORA, Roxb.

Woods near the shore, Rumpin River; Tahan woods.

Dracæna congesta, n. sp. Caulis brevis, sæpe vix tripollicaris, lignosus. Folia lanceolata acuta vel caudata vel elliptica caudata, petiolata, lamina atro-viridis, 6–9 pollices longa, 2–3 pollices lata, basi carinata; petiolus 3–6-pollicaris. Panicula breviter pedunculata, compacta, 3-pollicaris, pedunculo 2-pollicari. Flores plurimi arcte congesti, bini vel terni, pollicem longi, rubescenti-albi, pedicellis vix $\frac{1}{8}$-pollicaribus. Bracteæ parvæ, ovatæ acutæ. Sepala et petala ad dimidium libera, linearia, obtusa, tubo ad basin dilatato. Stamina filamentis gracilibus, antheris oblongis. Stylus gracilis, filiformis. Bacca aurantiaca, globosa monosperma, vel 2–3-loba, 2–3-sperma.

Limestone districts, Kota Glanggi, also in the Tahan woods. I have gathered this plant, too, in the limestone rocks of Kwala Lumpur.

It is easily distinguished by its exceedingly short stem and very compact panicle, almost capitular, very much shorter than the leaves, which are also remarkable for their long petioles.

D. longifolia, n. sp. Caulis fruticosus. Folia elongata, lanceolata acuminata, basi longe petiolata, petiolo alato, 2 pedes longa, 2½ pollices lata. Panicula foliis brevior, gracilis, laxa, pauci-ramosa, sesquipedalis, ramis ascendentibus, bracteis pluribus lanceolatis acuminatis acutis, dissitis in pedunculo et ad bases ramorum. Flores bini vel terni, bractea ovata, apposita, graciles, $\frac{3}{4}$-pollicares, pedicellis tenuibus, $\frac{1}{8}$-pollicaribus, albi, laciniis $\frac{3}{5}$ longitudinis liberis, marginibus tenuibus, tubo versus basin attenuato, dein incrassato. Antheræ oblongæ.

Tahan woods.

This *Dracæna* is distinguished by its narrow lanceolate leaves, tapering into a long-winged petiole, and by the short, graceful, erect panicle of few slender branches with small white flowers.

D. nutans, n. sp. (See Appendix, p. 406.)

PONTEDERIACEÆ.

Monochoria hastæfolia, Presl.

Common in pools and ditches along the River Pahang at Pekan, Renchong, &c.

M. vaginalis, Presl.

Even commoner than the last. Pekan, Kwala Tembeling, &c.

XYRIDEÆ.

Xyris pauciflora, Willd.

Open country, on sandy heaths, Pekan.

Xyris bancana, Miq.
With the last, but much less common.

Commelinaceæ.

Pollia thyrsiflora, Endl.
Tahan woods, in mountain streams.

Cyanotis barbata, D. Don.
Sandy heaths. Kwala Pahang to Pekan.

Forrestia marginata, Hassk.
Pulau Tijau, Pahang River, Tahan woods, &c.

F., sp.
Tahan woods.

Floscopa scandens, Lour.
Near Pekan.

Aneilema sinicum, Lindl.
Sandy places near the sea, Kwala Pahang.

A. nudiflorum, R. Br.
Very common. Pekan, Pulau Tawar, Kwala Tembeling, &c.; also in Kelantan at Kamposa.

A. vaginatum, R. Br.
A local plant, sandy places by the sea, Rumpin River.

A. imberbe, n. sp. Radices tenues, graciles. Caules erecti vel suberecti, plures, sesquipedales, teretes, nodis incrassatis, internodiis longis, 2-pollicaribus, foliati. Folia lanceolata acuminata, petiolata, 4 pollices longa, $1\frac{1}{4}$ pollices lata, petiolis canaliculatis, semipollicaribus, viridia, tenuia, glabra, costa subtus elevata, vaginis striatis, ore obliquo integro, $\frac{1}{2}$-pollicaribus, minute pubescentibus. Panicula terminalis 2-pollicaris, ramis paucis ultra-pollicaribus, pedunculo, ramis et ramulis pubescentibus, atro-purpureis. Bracteæ caducissimæ. Pedicelli glabri, $\frac{1}{8}$-pollicares. Flores parvi. Sepala 3, ovata, oblonga obtusa, cymbiformia, cartilaginea, pallide violascentia, 3-nervia. Petala 3, ovata obtusa, $\frac{1}{8}$ pollicem longa, violacea, tenuia. Stamina 3, glabra, filamentis basi crassis, superne attenuatis, violaceis. Anthera media major hippocrepica, flava, laterales minores, loculis subparallelis haud productis. Ovarium ovoideum, trigonum, album, stylo brevi, attenuato, violaceo. Capsula ovidea, triquetra, chartacea, $\frac{3}{16}$-pollicaris, acuta, sepalis loculis tribus. Semina singula in loculis, nigra, angulata, verrucosa, $\frac{1}{16}$-pollicaria.

Woods, Kwala Tembeling.

A pretty plant, allied to *Aneilema dimorphum*, but with perfectly glabrous stamens.

FLAGELLARIÆ.

FLAGELLARIA INDICA, Linn.

Common at the mouth of the Pahang River. "Rotan Binni" (wife's rattan) or "Rotan Tikus" (mouse, *i. e.* small rattan) of the Malays.

SUSUM ANTHELMINTICUM, Blume.

Woods near Pekan.

The common *Susum* here seems to belong to one species; the panicle is sometimes narrow and sometimes large and spreading. In the 'Flora of British India' the stem is given as 3–5 feet high of *S. anthelminticum*, but Jack correctly, as regards the Malayan plant (his *Veratrum*? *malayanum*), describes it as having the leaves radical, and so does Miquel (Flora Neder. Ind. iii. p. 347). I have never seen a stem so much as two feet high; the leaves are nearly always radical, in fact the plant only makes a stem at all when growing in deep wet spots.

PALMÆ.

ARECA CATECHU, Linn.

Commonly cultivated.

ACTINORHYTIS CALAPPARIA, H. Wendl. et Drude. (*Areca cocoides*, Griff.)

The men brought from one of the villages, a few miles above Pekan, a couple of fruits of this palm and asked if they could be used as betel-nuts. I only saw the tree in the distance. It is probably native here. The genus is omitted from the 'Flora of British India.'

PINANGA DISTICHA, Blume.

This charming little dwarf palm is abundant in the Tahan woods, and I also found it at Tanjong Antan, and at Pulau Tawar on the Pahang River. It is here called "Pinang Luggong."

P. MALAYANA, Scheff.

Kwala Tenok, Tahan River, in wet places.

P. SUBRUMINATA, Becc.

Rumpin River (*W. Fox*).

P. PERAKENSIS, Becc. ?

Tahan woods.

NENGA WENDLANDIANA, Scheff., var. **MALACCENSIS**.

Tahan woods, also near Pekan.

This palm, which is very common in swampy forests in Singapore, is called "Pinang Umu" (Purple Pinanga) by the natives, on account of its red leaf-sheaths.

NENGA MACROCARPA, Scort.
Kwala Tenok, Tahan River.

CYRTOSTACHYS LACCA, Becc.
Wet woods at Pramau, near Pekan.

ONCOSPERMA HORRIDA, Scheff.
The "Bayas" of the Malays is fairly common in the Tahan woods, as elsewhere. The Malays use the seed as a substitute for betel-nut, and the cabbage is fairly good.

IGUANURA MALACCENSIS, Becc.
Kwala Tenok, Tahan woods.

I. GEONOMÆFORMIS, Mart.
Pulau Chengei, Kota Glanggi.

DIDYMOSPERMA HOOKERIANA, Becc.
Kota Glanggi woods.

ARENGA OBTUSIFOLIA, Mart. (*A. Westerhoutii*, Griff.)
Plentiful at one spot in the Tahan woods, and also at Temerloh on the Pahang River.

This is a fine palm, about 20 feet in height, with a grey stem, conspicuously ringed and about 6 inches thick. The leaves are 15 to 20 feet long, grey beneath. Male flowers reddish brown.

CARYOTA MITIS, Lour.
Not rare in thickets and woods along the Pahang River, as at Blay Manis.

The mealy tomentum from the base of the leaf-sheaths is collected by the aborigines for tinder, and used in the fire-raising apparatus.

ORANIA MACROCLADUS, Mart.
The "Ebol" of the Malays. Occurred sparingly in the Tahan Valley woods.

NIPA FRUTICANS, Wurmb.
Mouth of the Pahang River.

LICUALA SPINOSA, Mart.
Open country along the Pahang River, at Tanjong Antan, and Pulau Chengei.

L. PUSILLA, Becc.
At Pulau Tijau, Pahang River.

L. sp. aff. ORBICULARIS, Becc.
A very small plant in the woods near Pulau Tawar.

LICUALA LONGIPES, Griff.

Woods at Pulau Tawar.

TEYSMANNIA ALTIFRONS, Miq.

This fine palm was plentiful in various parts of the Tahan woods at a rather high elevation. It is called "Daun Payoh" (Umbrella-leaf), and the leaves were very welcome to the coolies for making shelters for the night.

ZALACCA BLUMEANA, Mart.

Tahan woods.

The fruits of this "Salak" are remarkably rough; the spines, which are curved towards the apex of the fruit, are longer than in any other species known to me. As in *Z. conferta*, Griff., the commonest species in Singapore, the fruits are very pleasantly acid.

Z. WALLICHIANA, Mart.

Also occurred in the Tahan woods.

In many places these Zalaccas form dense thickets, almost impenetrable from the sharp spines on the leaves.

CALAMUS JAVENSIS, Blume.

Kwala Tembeling. "Rotan Lilin" of the Malays.

C. CASTANEUS, Griff.

Tahan woods.

C. CRINITUS, Miq.

Common, forming dense thickets. Pahang and Tahan Rivers.

Not seen in flower or fruit; indeed it is very rare to find this plant in flower.

C. LEPTOSPADIX, Griff. ?

A rattan with extraordinarily long, slender, much-branched spadices hanging down many feet. Fruit somewhat globose, resembling that of *C. grandis*, Griff., but lighter yellow. Tahan woods.

C. CILIARIS, Blume, var. ?

A most delicate rattan, with very pubescent foliage. Tahan woods.

C. MELANOCARPUS, mihi.

Pulau Tawar.

This is by no means a rare species in Singapore, though it rarely flowers. It is easily recognized by its deep green leaves with white backs, and its peculiar obpyriform acute black fruit. It belongs to the section *Cymbospathæ*.

Two or three others were collected with flowers, but I have not identified them.

PLECTOCOMIA ELONGATA, Blume.
Pramau woods, near Pekan. "Rotan Dahan" of the Malays.

PANDANEÆ.

PANDANUS ODORATISSIMUS, Roxb.
"Pandan Duri." Sea-shores, Kwala Pahang, Cherating.

P. **FURCATUS**, Roxb.
"Mengkuang." Tanjong Medang, Tahan woods.

P. sp. aff. **HELICOPUS**, Miq., but with broader leaves.
Tahan woods.

Far up the Tahan River I saw some plants of an epiphytic (not climbing) *Pandanus* which forms great round tufts of long narrow leaves in the upper branches of the trees, often very difficult of access, and I met with the same, or an allied species, in the Larut Hills, in Perak, but as yet have not seen flowers or fruits.

AROIDEÆ.

CRYPTOCORYNE CILIATA, Blume.
Pools in sandy ground, Tringganu.

C., sp.

A species allied to, if not identical with, the common Singapore one was plentiful in the River Tahan, but I saw no flowers nor fruit. It has bullate leaves, dark green above, purplish beneath.

PISTIA STRATIOTES, Linn.
Pools, Pekan.

ARISÆMA FIMBRIATUM, N. E. Br.
Kota Glanggi, on the top of the limestone rocks.

TYPHONIUM DIVARICATUM, Blume.
Common, Pekan, Pulau Jellam, &c., in waste ground.

AMORPHOPHALLUS, spp.

The foliage of three species was met with: one with a plain green smooth stem, at Kota Glanggi, on the limestone rocks; another, probably *campanulatus*, with a smooth, mottled, and variegated stem, at Tahan and elsewhere; and a third, with a very scabrid mottled stem, at Pulau Tawar. Fruit of one of these species was also found at Kwala Tahan.

In the absence of flowers I cannot identify these with certainty.

COLOCASIA ANTIQUORUM, Schott.

Commonly cultivated. It occurred as an escape from cultivation or accidentally planted in the Tahan valley woods, far from the mouth.

ALOCASIA LONGILOBA, Miq.

This appears to be the name of the common wild *Alocasia* so abundant in the Singapore woods. The foliage is very variable in shape, and in seedlings is peltate, and not bilobed at all like those of *A. perakensis*, Hemsl. I do not understand exactly the difference between *A. longiloba* and *A. denudata*, Engl., which is said to be a Singapore plant, but I know only one species as a wild plant here. *A. longiloba*, Miq., is plentiful at Pekan, but becomes scarcer further in the province. I met with it, however, far up the Tahan River.

AGLAONEMA SCHOTTIANUM, Miq.?

Kwala Tenok, Tahan River.

A. PICTUM, Kunth, var.

Pramau woods.

HOMALONEMA AROMATICA, Schott.

Kwala Tahan. Common.

CHAMÆCLADON GRIFFITHII, Miq.

Common, Tahan woods.

There is a very pretty silvery-leafed form of this plant which is not rare in damp forests. I have seen it in Malacca and Selangor, and it was plentiful in the Tahan woods. At first sight it looks very different from the common green-leafed form, but I can find no constant specific difference. The leaves are very variable, as indeed in most Aroids. The petiole is stout, slender, sheathed for from less to half to two-thirds of its length; the base of the leaf-blade is usually rounded and the broadest part, or it may be quite acute. The silvery-leafed form may be characterized as var. *argentea*.

Leaves silvery above, pale beneath, with red veins; petioles red; spathes red.

There are two other species of *Chamæcladon* in the collection—one, perhaps *C. saxorum*, Miq., from Kota Glanggi, and the other from the Tahan woods.

SCHISMATOGLOTTIS, spp.

Several species were met with in Pahang, and I have others from Singapore and elsewhere which I cannot identify with any described species. They have, however, probably been described among the Aroids of the 'Flora of British India,' the part containing which has not yet reached me.

RHYNCHOPYLE ELONGATA, Engl.

Tahan woods, on rocks in the Tahan valley.

RHYNCHOPYLE, sp.

Apparently undescribed; a very curious little plant with rather long creeping rhizomes, covering densely the rocks in the Tahan River. Leaves dark green, very narrowly lanceolate. I do not remember ever to have seen any terrestrial Aroid forming such a mat on the rocks as this did.

ANADENDRUM MONTANUM, Schott. Kota Glanggi.

A most unfortunate specific name for this typically lowland Aroid. It is very common in Singapore, growing on the lower parts of trees to about eight or nine feet from the ground.

SCINDAPSUS CRASSIPES, Engl.?

On the sea-shore at Tringganu. Only one plant met with growing on an old stump. A very fleshy plant, with dark green leaves and a white spathe. It appears to differ from Engler's figure in having broader flowers.

RAPHIDOPHORA BECCARII, Engl. Kwala Tahan.

LASIA SPINOSA, Lour. Abundant at Ayer Hitam, near Pekan, in a swampy thicket; also in a damp wood near Kwala Mahang.

CYRTOSPERMA LASIOIDES, Griff. Kwala Mahang. Common in open swampy country.

POTHOS RUMPHII, Schott. Woods, Kwala Tembeling, Pulau Tawar.

P. aff. OXYPHYLLUS, Miq. Pulau Tawar.

ALISMACEÆ.

LIMNOPHYTON OBTUSIFOLIUM, Miq. Pulau Tawar, in a small pool.

LOPHIOCARPUS GUYANENSIS, Mich. Renchong, in a buffalo-wallow.

NAIADACEÆ.

NAIAS INDICA, Linn. I believe this is the name of the common peninsular species. I found it in a pool on the heath at Pekan.

ERIOCAULEÆ.

ERIOCAULON WALLICHIANUM, Mart. Common at Pekan.

E. SEXANGULARE, Linn. Damp spots, Pekan.

CYPERACEÆ.

CYPERUS POLYSTACHYUS, Rottb. Common in Pahang and in Kelantan.

C. ERAGROSTIS, Vahl. In a small pool at Kwala Tembeling.

CYPERUS ALOPECUROIDES, Rottb. River-bank, Kamposa in Kelantan.

C. COMPRESSUS, Linn. Common throughout Pahang.

C. ZOLLINGERI, Steud. Common in open country, near villages, Pekan.

C. GRIFFITHII, Steud. Sea-shores, all along the Pahang coast and in Kelantan.

C. HASPAN, Linn. Common in swamps and marshes all up the Pahang River.

C. PULCHERRIMUS, Willd. Marshy spots, Pekan.

C. ELEGANS, Linn. Woods, Pekan, and up as far as the Tahan woods.

C. TURGIDULUS, C. B. Clarke. Pahang and Rumpin Rivers.

C. IRIA, Linn. I have gathered this only in Kelantan at Kamposa. It is a weed of cultivation, and probably occurs in Pahang.

C. DISTANS, Linn. Common. Pahang and Kelantan, in open country.

C. MALACCENSIS, Lam. In tidal and saline mud. Pahang, at Pekan, at Tringganu, and at Kamposa in Kelantan.

C. PILOSUS, Vahl. Exceedingly common in damp spots, Pahang.

C. PROCERUS, Rottb. Not common. Kelantan at Kamposa.

C. ROTUNDUS, Linn. Very common in cultivated ground in Pahang.

C. STOLONIFERUS, Retz. Near Pekan.

C. AURICOMUS, Sieber. Sandy spots in the Pahang River, Pasir Loyang, Pekan; also Kamposa in Kelantan.

C. FERAX, A. Rich. Common up the Pahang River at Kwala Luit, Pasir Loyang, and Pekan.

MARISCUS DILUTUS, C. B. Clarke. Pekan; Kelantan at Kamposa.

M. PENNATUS, Lam. Sea-shores and river-mouths, Pahang at Sungei Meang, and Kelantan at Kamposa.

M. BIGLUMIS, Gaertn. Not rare, on Pulau Tiuman off Johore; Tahan River-banks, Pahang.

——, var. CYPERINA. Pekan and Pulau Tiuman.

M. DUBIUS, Rottb. Common near the sea, mouth of Pahang River, Rumpin River, Sungei Meang, Kelantan at Kamposa.

MARISCUS UMBELLATUS, Vahl. Common in Pahang.

KYLLINGA BREVIFOLIA, Rottb. Very common in open country.

K. MONOCEPHALA, Rottb. Not rare, Pekan, &c.

FIMBRISTYLIS NUTANS, Vahl. Wet spots in sandy country, Rumpin River, Kwala Pahang.

F. PAUCIFLORA, R. Br. Very common in dry open spots.

F. ARGENTEA, Vahl. Kelantan, Kamposa; rare.

F. ÆSTIVALIS, Vahl. Common in swamps all up the Pahang River, and at Rumpin River.

F. ASPERRIMA, Boeck. In woods, Kwala Tembeling; Tahan woods.

F. TENERA, var. OBTUSATA, C. B. Clarke. Kwala Pahang.

F. MILIACEA, Vahl. Very common all up the Pahang River, and at Kamposa in Kelantan.

F. GLOBULOSA, Kunth. Damp spots, Kwala Pahang, Pekan, and Pulau Chengei.

F. GLOMERATA, Nees. Kwala Pahang; Cherating River.

F. DIPHYLLA, Vahl. Very common everywhere.

F. LEPTOCLADA, Benth. Kwala Pahang.

F. SETACEA, Benth. Pekan, local.

F. LONGISPICA, Steud. Heaths near the sea, Kwala Pahang; Pramau; Rumpin River.

F. TETRAGONA, R. Br. Sandy heaths, Kwala Pahang.

F. SERICEA, R. Br. Sandy places near the sea, Sungei Meang; Kwala Pahang; Cherating River; also at Kamposa in Kelantan.

BULBOSTYLIS BARBATA, Kunth. Very common in sandy spots in Pahang; also in Tringganu at Pulau Ketam.

SCIRPUS MUCRONATUS, Linn. Common in pools, Pekan, Tanjong Gajah Mati.

S. GROSSUS, Linn. f. Kwala Tembeling; Pekan; also at Kamposa in Kelantan.

S. JUNCOIDES, Roxb. Rice-fields, Temerloh.

TRICOSTULARIA BORNEENSIS, Benth. Sandy heaths near the sea from Kwala Pahang to Pekan; also at Pulau Ketam in Tringganu.

FIURENA GLOMERATA, Lam. Common in wet country all through Pahang.

Lipocarpha argentea, R. Br. Common in open country.

Eleocharis chætaria, Roem. & Schult. Common in marshes all along the Pahang River.

E. variegata, Kunth ?, var. laxiflora. Kwala Pahang in ditches.

E. ochrostachys, Steud. Near Pekan.

Lepironia mucronata, Rich. Abundant in Chenei Lake, Pahang River (*W. Fox*).

Mapania palustris, Benth. & Hook. f. Woods, Kwala Tenok, Tahan River.

M. humilis, Naves. Tahan woods.

Hypolytrum latifolium, Rich. Near Pekan.

Remirea maritima, Aubl. Sea-shore, Cherating, Sungei Meang, Kwala Pahang, &c.

Rynchospora aurea, Vahl. Very common in open country.

R. Wallichiana, Kunth. Kwala Pahang, heath country.

Schœnus calostachyus, Poir. Heath country near Pekan.

Scleria caricina, Benth. Common near Pekan.

S. chinensis, Kunth. Kwala Pahang.

S. lithosperma, Nees. Common, Rumpin River, Kwala Pahang.

S. hebecarpa, Nees. Near Pekan.

S. malaccensis, Boeck. Common near Pekan.

S. multifoliata, Boeck. Scrambling through thickets, Pekan.

S. lævis, Willd. Pulau Tawar, Kwala Pahang.

S. sumatrensis, Retz. Kwala Pahang.

S. Ridleyi, C. B. Clarke. Pulau Tawar, open country.

Carex divaricata, Wall.

Very abundant on the rocks overhanging the Tahan River, and also in the upper part of the Pahang River.

This plant appears to have been found by Wallich at "Saluen ad Neergye" in 1827 (no. 3533 of his collection), and has lain hid in his herbarium for many years. It has apparently never been described.

I am indebted to Mr. C. B. Clarke for the identification of this as well as nearly all the other Cyperaceæ in this list.

GRAMINEÆ.

PASPALUM SCROBICULATUM, Linn. Common everywhere in open country in Pahang, and also in Kelantan at Kamposa.

P. CONJUGATUM, Berg.

Common in the low country, and as far up the River Tahan as the expedition went, growing here on the rocks in the stream. It has penetrated further through the jungle than any other South-American introduction, and has, I believe, been carried there in the clothes of the natives in search of gutta-percha, &c. The spikelets are very adhesive, especially in wet weather. I found a plant of this at Padang Batu on Mount Ophir, in a crevice of the rocks of the stream close to the camping-ground, just at the spot where the natives who come up, either with Europeans or alone in search of drug-plants, are in the habit of bathing and washing their clothes.

P. DISTICHUM, Burm. In salt mud, Sungei Meang, near Kwala Pahang.

ISACHNE AUSTRALIS, R. Br. Common in swamps and wet spots along the Pahang River.

I., sp. At Kwala Luit.

OPLISMENUS COMPOSITUS, Beauv. Shady thickets at Kwala Pahang.

PANICUM (§ DIGITARIA) SANGUINALE, Trin. Very common in open country, on sand-banks, &c., far up the rivers.

P. PARVULUM, Nees. Sungei Meang.

P. HETERANTHUM, Nees. Sandy shores, not common, Rumpin River, Sungei Meang.

P. (§ PTYCHOPHYLLUM) PLICATUM, Lam. Not common, Tahan River banks.

P. (§ BRACHIARIA) NODOSUM, Kunth. Common in thickets, Kwala Tembeling, Pulau Manis, Pahang River, Pekan; also at Kamposa in Kelantan.

P. SUBQUADRIPARUM, Trin. Pekan, Pulau Tawar.

P. (§ ECHINOCHLOA) COLONUM, Linn. Common in waste ground and around pools, &c., Pulau Manis, Mahang; on the Pahang River.

P. CRUS-GALLI, Linn. Not common, Temerloh; also at Kamposa in Kelantan.

P. (§ MILIARIA) HUMILE, Nees. Open grassy fields at Pulau Tawar.

P. TRIGONUM, Retz. Common in woods, Pekan, Tahan River.

P. OVALIFOLIUM, Retz. Shady places, Kwala Pahang.

P. RADICANS, Nees. Common in thickets, Pekan, Pulau Rumput, Pahang River; Tahan woods.

PANICUM RIDLEYI, Hack. Not rare in woods and thickets, Kwala Berar, Pekan, Pahang River, Kwala Tembeling; Tahan River woods.

P. LUZONENSE, Presl. Roadsides near Pekan.

P. (§ HYMENACHNE) AURITUM, Presl. Pools and ditches, Pekan; Pasir Loyang; and Pulau Manis on the Pahang River; Khol, on Tembeling River.

P. (§ HYMENACHNE) INDICUM. Very common on sandbanks, open country, &c., all along the Pahang and Tembeling Rivers.

P. MYOSUROIDES, R. Br. Pekan, Khol, and Kwala Tembeling.

P. MYURUS, Lam. Pools, Mahang.

SETARIA ITALICA, Beauv. Cultivated under the name of "Iskoy" at Pulau Tawar.

S. DASYURA, Beauv. Open country, Pekan, Kwala Luit.

S. GLAUCA, Beauv. Pekan.

THUAREA SARMENTOSA, Thou. Sandy shores at Rumpin River, Cherating, and Sungei Meang.

SPINIFEX SQUARROSUS, Labill. Sandy shores of the sea at Rumpin, Cherating, Sungei Meang, and Kwala Pahang.

LEPTASPIS URCEOLATA, R. Br. Woods, Pulau Jellam.

ORYZA SATIVA, Linn., is cultivated, but not very extensively.

O. SATIVA, var.? Two curious wild forms, possibly distinct species: one at Pekan, in damp muddy thickets, and one on the Tahan River.

LEERSIA HEXANDRA, Sw. Common in swamps, Pekan, &c.

PEROTIS LATIFOLIA, R. Br. Sandy places near the sea, Kwala Pahang, as far up as Pekan.

ZOYSIA PUNGENS, Linn. With the last.

IMPERATA CYLINDRICA, Cyr. Common.

POLLINIA CILIATA, Trin. Local; when met with it was abundant, but flowering scantily. Renchong, Pahang River; Tahan River banks.

P. RIDLEYI, Hack. Sandy coasts, Rumpin River, Sungei Meang. Not known elsewhere.

SACCHARUM ARUNDINACEUM, Retz. Very common all up the Pahang and Tembeling Rivers.

Saccharum Ridleyi, Hack. Common near Pekan, on the river-banks. Not known elsewhere.

Rottboellia glandulosa, Trin. Common in thickets. Pahang River; Rumpin and Tahan Rivers.

R. geminata, Hack. Borders of woods, Rumpin River, Pekan. Not known elsewhere.

Ischœmum muticum, Linn. Very common everywhere.

Apluda varia, var. intermedia, Hack. River-banks, Mahang and near Pekan.

Manisuris granularis, Sw. Banks of river at Pulau Tawar.

Pogonatherum polystachyum, R. Br. Very common. River-banks, Pahang and Tahan Rivers.

Andropogon (§ Amphilophis) intermedius, R. Br. Pekan.

A., sp. Kwala Tenok, Tahan River.

A. (§ Heteropogon) contortus, Linn. Heath country, Kwala Pahang.

A. aristulatus, Hochst. Kwala Pahang, Pekan.

A. aciculatus, Retz. Very common all along the Pahang and Tembeling Rivers.

Themeda gigantea, Hack., var. villosa. Pulau Tawar, Mahang, &c. It is called "Timpayang."

T. arundinacea, mihi. Pekan, open country. I have seen only one specimen, collected by Dr. Haviland.

Sporobolus elongatus, Beauv. Dry heathy country, Pekan.

Eriachne chinensis, Benth. Common on heaths at Pekan.

E. triseta, Nees. Heath country round Pekan.

Cynodon Dactylon, Linn. Common, and rather variable. Pulau Tawar, Pekan.

Eleusine ægyptiaca, Linn. Sea-coasts. Kwala Pahang, Sungei Meang, &c.

E. indica, Linn. Very common in waste ground all up the Pahang River.

Leptochloa chinensis, Nees. River-banks, Kamposa in Kelantan; Kwala Tembeling and Kwala Semantan, Pahang River.

L., sp. In a pool, Pulau Tawar.

Eragrostis zeylanica, R. Br. Damp spots, heath country, Kwala Pahang.

Eragrostis plumosa, Retz. Very common. Pekan, &c., in Pahang, and Kamposa in Kelantan.

E. Brownii, Kunth. Common. Kwala Pahang and Kamposa in Kelantan.

E. ferruginea, Thunb. Heaths, Kwala Pahang.

E. unioloides, Nees. Very common in Pahang and Kelantan.

E. nutans, Retz. Heathy country near Pekan.

Phragmites Roxburghii, Kunth. Common all up the Pahang River. Pulau Chengei; Temerloh; Pulau Tawar.

Centotheca lappacea, Beauv. Common in woods from Kwala Pahang to Tahan.

Lophatherum gracile, Brongn. Common in the Tahan woods.

Lepturus repens, R. Br. Sandy shores, Rumpin River, Sungei Meang.

Several species of Bamboo occur in various parts of Pahang and Kelantan, but I was never fortunate enough to secure flowers of any.

Lycopodiaceæ.

Lycopodium cernuum, Linn. Common in open country everywhere. Kwala Pahang, &c.

L. phlegmaria, Linn. Kwala Pahang, Pekan.

L. nummularifolium, Blume. Tahan River, on trees.

Selaginella Wallichii, Spring. Tahan River.

S. Willdenovii, Baker. Tanjong Antan, Kota Glanggi, Pulau Tiuman.

S. inæqualifolia, Spring. Tahan River.

S. flabellata, Spring. Kota Glanggi woods.

S. caulescens, Spring. Tanjong Antan.

S. plumosa, Baker. Tahan River.

FILICES.

Cyathea Brunonis, Wall. Banks of Tahan River.

Hymenophyllum Blumeanum, Spreng. River Tahan woods.

H. polyanthos, Sw. Several forms of this variable plant were collected in the Tahan woods.

HYMENOPHYLLUM NEESII, Hook. River Tahan woods.

TRICHOMANES DIGITATUM, Sw. Tahan woods.

T. JAVANICUM, Blume. Common in the Tahan woods. A very much finer fern than the common Singapore woodland one, with a stout stem and the deep green fronds forming a complete circle.

T. RIGIDUM, Sw. Tahan woods.

T. TRICHOIDEUM, Sw. Tahan woods.

HUMATA HETEROPHYLLA, J. Sm. Pekan, common.

H. PEDATA, J. Sm. Tahan woods.

PROSAPTIA CONTIGUA, Presl. On wet mossy trees in the Tahan Valley.

DAVALLIA BULLATA, Wall. Kota Glanggi.

D. ELEGANS, Sw. Pekan; Cherating River.

MICROLEPIA SPELUNCÆ, T. Moore. Kwala Tahan. Also met with at Kamposa in Kelantan.

STENOLOMA CHINENSIS, Fée? Kwala Tahan.

LINDSAYA SCANDENS, Hook. Common, Tahan woods.

L. CULTRATA, Sw. Typical form on rocks in Tahan River.

——, var. LOBBIANA, Ridl. Tahan woods.

L. FLABELLULATA, Dryand. Tahan woods.

L. DAVALLIOIDES, Blume. Tahan River woods.

SCHIZOLOMA LOBATA (*Lindsaya lobata*, Poir.). River Tahan.

ADIANTUM CAPILLUS-VENERIS, Linn. Rocky banks of the Tahan; local, but plentiful in spots.

PTERIS GREVILLEANA, Wall. Pekan, where it is called "Seala Kayu."

P. SEMIPINNATA, Linn. Passir Loyang. "Paku Medang" (Laurel Fern) of the natives.

P. AQUILINA, Linn. Abundant in the sandy country.

CERATOPTERIS THALICTROIDES, Brongn. Common in swamps and ditches. Kwala Pahang, &c.

BLECHNUM ORIENTALE, Linn. Pekan.

THAMNOPTERIS NIDUS, Presl. Very common

——, var. MUSÆFOLIA, Ridl. Tahan woods.

——, var. PHYLLITIDIS, Ridl. Common.

ASPLENIUM LONGISSIMUM, Blume. Pramau, Pekan.

A. HIRTUM, Kaulf. Tahan woods.

A. NITIDUM, Sw. Pulau Tiuman.

A. RESECTUM, Sm. Tahan woods.

A. PALLIDUM, Blume. Tahan woods.

DIPLAZIUM PORRECTUM, Presl. Tahan woods.

D. TOMENTOSUM, Blume. Tahan woods.

D. SORZOGONENSE, Presl. Tahan woods.

D. TENERUM, Presl. Pulau Tawar.

ANISOGONIUM ESCULENTUM, Presl. Pulau Manis, &c.; common.

MESOCHLÆNA POLYCARPA, R. Br. Tahan woods, Pulau Padang, Pahang River.

ASPIDIUM SINGAPORIANUM, Wall. Kwala Tenok, Tahan woods.

A. VASTUM, Blume. Khol, Tembeling River.

A. CICUTARIUM, Sw. Tahan woods.

A. TERNATUM, Baker. Pramau.

A. SEMICORDATUM, Sw. Tanjong Antan.

LASTREA IMMERSA, Blume. Kwala Tahan.

L. CRASSIFOLIA, Blume. Kota Glanggi.

NEPHRODIUM ARIDUM, Baker. Pekan.

N. CALCARATUM, Hook. River Tahan.

N. UROPHYLLUM (*Polypodium urophyllum*, Wall.). Common in the woods, Pulau Tawar, Temerloh, Kota Glanggi.

N. AMBOINENSE, Presl. Khol, River Tembeling, where it is called "Paku Anjing" (Dog Fern).

NEPHROLEPIS ACUTA, Presl. Kwala Tembeling, &c.

DICTYOPTERIS DIFFORMIS, T. Moore. Tanjong Antan.

POLYPODIUM SUBEVENOSUM, Baker? On rocks in Tahan River.

P. NIGRESCENS, Blume. Pekan.

NIPHOBOLUS ACROSTICHOIDES, J. Sm. Kwala Pahang.

N. PENANGIANUS, Hook. Kota Glanggi.

N. NUMMULARIÆFOLIUS, J. Sm. Common, Kwala Pahang.

DIPTERIS HORSFIELDII, Bedd. (*Polypodium Horsfieldii*, R. Br.). Rare, in one place in the Tahan woods.

D. LOBBIANA, T. Moore. Rocky banks of Tahan River; grows in great profusion in some places.

DRYNARIA RIGIDULA, Sw. Tahan woods.

D. QUERCIFOLIA, J. Sm.? Kwala Pahang, Kwala Tembeling.

D. LINNÆI, Bory. Pulau Datoh, Pulau Chengei.

SELLIGUEA FEEI, Bory. Common, Tahan woods.

MENISCIUM TRIPHYLLUM, Sw. Tahan woods.

ANTROPHYUM PLANTAGINEUM, Kaulf. Kota Glanggi, Tahan woods.

VITTARIA ELONGATA, Sw. Pramau, Pekan.

V. SCOLOPENDRINA, Thw. Tahan woods.

TÆNITIS BLECHNOIDES, Sw. Common, Pulau Tawar, Kwala Tembeling, Temerloh. Known as "Paku Pijai."

ELAPHOGLOSSUM, sp. Only one specimen, Tahan woods.

STENOCHLÆNA SORBIFOLIA, J. Sm. Tahan woods.

GYMNOPTERIS FLAGELLIFERA, Wall. Pulau Tiuman woods.

ACROSTICHUM AURITUM, Sw. Kota Glanggi.

A. AUREUM, Linn. Kwala Pahang.

SCHIZÆA DICHOTOMA, Sw. Common, Rumpin River, Pramau, Pekan, Tahan River, in sandy spots.

S. DIGITATA, Sw. Common, Tahan, Kwala Tembeling, Pekan.

Lygodium dichotomum, Bedd. Common, Tahan River, &c.

L. polystachyum, Wall. Kwala Tembeling.

L. pinnatifidum, Sw. Kwala Tembeling.

Angiopteris evecta, Hoffm. Seen only in one place close to the village, Pekan.

Helminthostachys zeylanica, Hook. Not rare in thickets, Pekan, Pulau Manis, Pulau Jellam, Passir Loyang, Temerloh.

APPENDIX.

[Note.—Since the preceding pages were in type the following descriptions of new plants have been received from the Author.—Sec. L. S.]

P. 374. **Acriopsis purpurea**, n. sp. Pseudobulbi oblongi, læte virides, ¾ pollicem longi, ½ pollicem crassi, congesti. Folia oblanceolata bina, 1½ pollices longa, ½ pollicem lata, tenuiora, apicibus obtusis. Scapus 5-pollicaris, validulus, haud ramosus. Flores circiter 13 secundi, iis *A. javanicæ* majores et carnosiores, atro-purpurei; pedicelli violacei, cum ovariis viridibus, ½ pollicem longi. Bracteæ ovatæ acutæ, parvæ, pedicellos amplectentes. Sepalum posticum angustum, apice abrupte decurvo, obtuso, cucullato, atro-purpureum, apice flavescente; lateralia paullo latiora, connata. Petala spathulata obtusa, ⅛ pollicem longa. Labellum porrectum, basi angustatum, lamina hastata truncata, auriculis parvis, ad basin margine crispo, callo quadrangulari in medio, violaceo-roseum, margine albo. Columna kermesina, clinandrio cucullato profundo, margine albo, brachiis rectis subacutis; rostello minimo acuto.

On trees in a small thicket at Pramau, near Pekan; rare.

A very compact little plant, remarkable for its broad rounded leaves and its deep maroon-purple secund flowers. The lip is of the shape of a spade with two little ears projecting backwards at the base and a small white square callus in the centre. The oblong pseudobulbs are composed of two internodes, each of which emits a leaf.

P. 388. **Dracæna nutans**, n. sp. Caules debiles subscandentes, graciles, ¼ pollicem crassi, internodiis brevibus, grisei. Folia angusta, linearia acuminata mucronata, 12 pollices longa, ½ pollicem lata, læte viridia. Panicula nutans bipedalis; ramis gracilibus, longis, 6–7, remotis. Bracteæ parvæ, ovatæ acutæ, brunneæ. Flores bini aut singuli, pedicellis ½ pollicem longis, virescenti-albi, 1½ pollices longi, graciles, basi dilatata, superne teretes, lobis perianthii liberis ad ⅔ longitudinis, linearibus, spathulatis obtusis. Stamina filamentis flavis, quam perianthium brevioribus. Stylus filiformis, perianthium superans, album. Bacca aurantiaca, globosa, mediocris, seminibus 1–2.

In damp spots by the river Ayer Hitam, near Pekan. An elegant half-scandent *Dracæna*, with numerous narrow leaves crowded towards the top of the bare stems. The flowers are in a large loose panicle, and for them alone the plant is well worth cultivation.

DESCRIPTION OF THE PLATES.

Plate LXI.

Pomazota sylvestris, n. sp.

A. Complete plant (life-size).
B. Flower (enlarged).
C. Flower, from in front (enlarged).
D. Flower, corolla opened (enlarged).
E. Bud (enlarged).
F. Calyx and ovary (enlarged).
G. Ovary in section (enlarged).
H. Anther dehiscing.
I. Seed.

Plate LXII.

Geophila melanocarpa, n. sp.

A. Complete plant (natural size).
B. Flower (enlarged).
C. Flower, in section (enlarged).
D. Style (enlarged).
E. Stamen (enlarged).
F. Seed, outer side (enlarged).
G. Seed, inner side (enlarged).

Plate LXIII.

Spiladocorys angustifolia, n. sp.

A. Whole plant (natural size).
B. Flower (enlarged).
C. Coronal scale (enlarged).
D. Stamen, inner face (enlarged).
E. Pollinia (enlarged).
F. Capsule (enlarged).
G. Seed.

Plate LXIV.

Cirrhopetalum planibulbe, n. sp.

A. Plant (natural size).
B. Pseudobulb, from beneath (enlarged).
C. Pseudobulb, in section.
D. Flower, front view (enlarged).
E. Lip (enlarged).
F. Column and lip, side view (enlarged).
G. Petal (enlarged).
H. Anther (enlarged).
I. Pollinia (enlarged).

Plate LXV.

Lecanorchis malaccensis, n. sp.

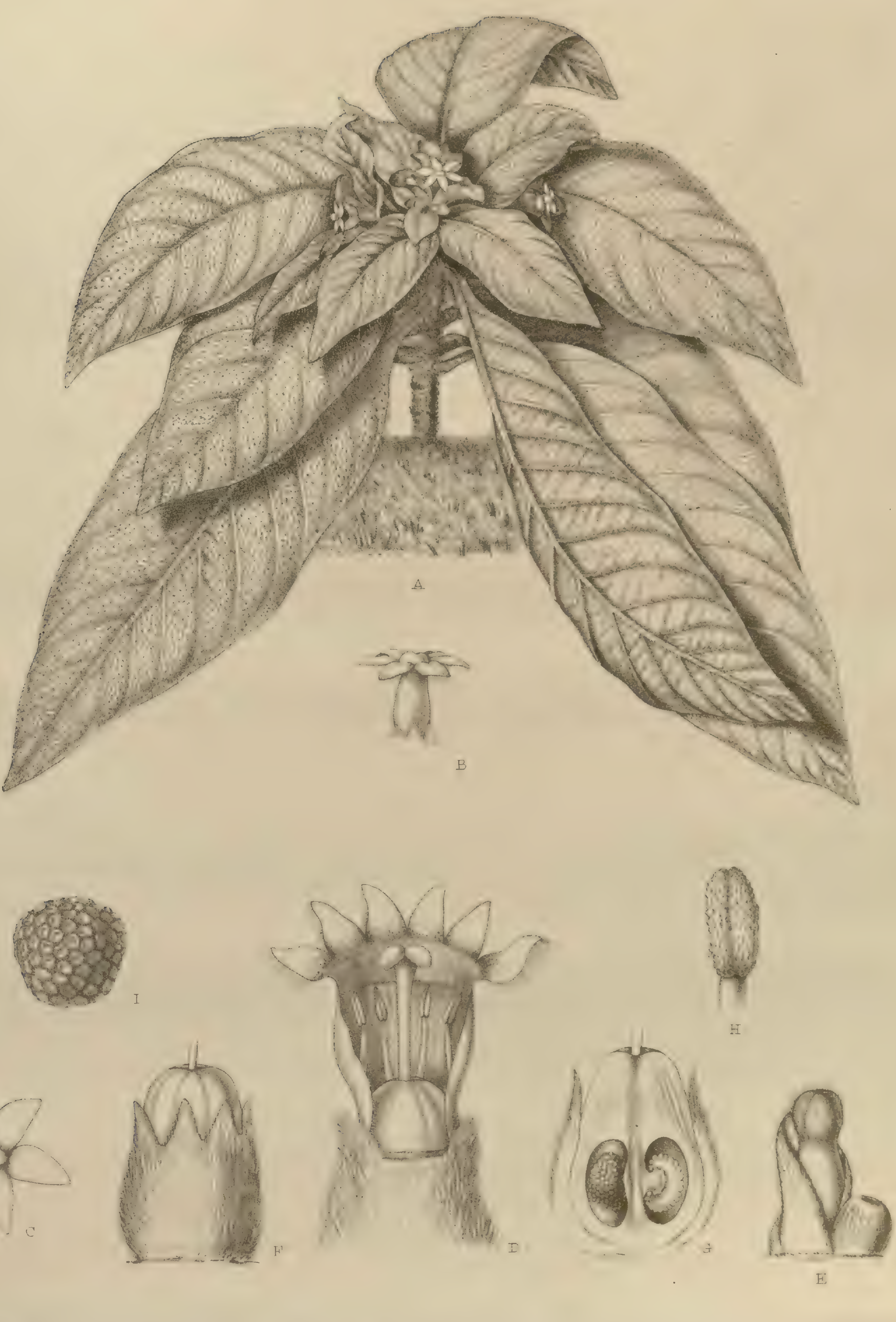
A. Whole plant (natural size).
B. Sepal and petal (natural size).
C. Petal (natural size).
D. Lip and column (natural size).
E. End view of lip and column (enlarged).
F. Column, from in front, of a freshly-opened flower (enlarged).
G. Side view of the same (enlarged).
H. Front view, at a later stage; pollinia in contact with the stigma (enlarged).
I. Cupule on the apex of ovary (enlarged).

Plate LXVI.

Protamomum maxillarioides, n. sp.

A. Plant (natural size).
B. Petal (enlarged).
C. Front view of the flower, sepals and lip removed (enlarged).
D. Back view of the same (enlarged).
E. Stamen (enlarged).
F. Capsule (natural size).
G. Ovary, in section (enlarged).
H. Seed (enlarged).

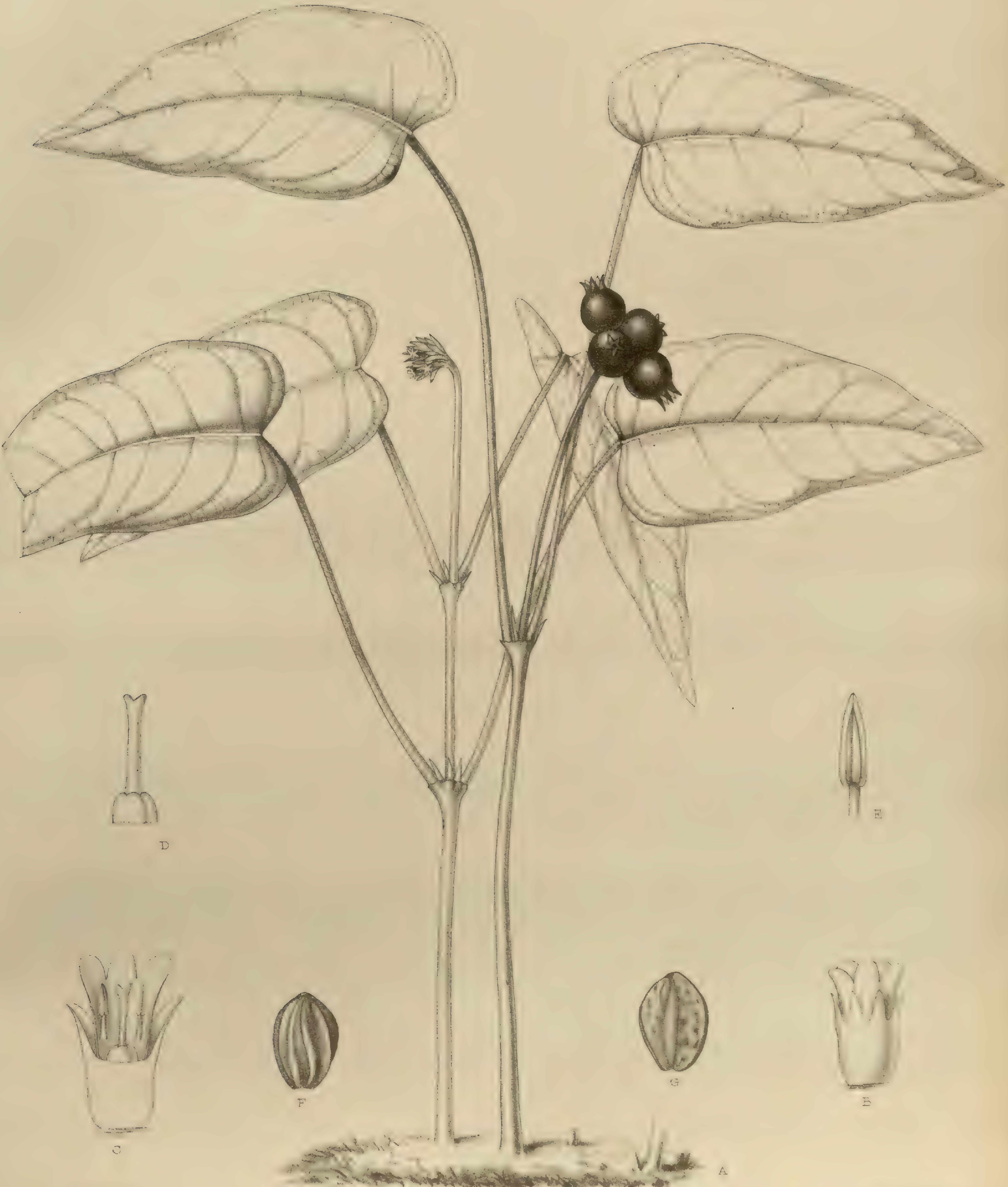
Ridley. TRANS. LINN. SOC. BOT. SER. 2. VOL. III. PL. 61.



J. D'Alwis del. viv.
F. Morgan lith.

POMAZOTA SYLVESTRIS

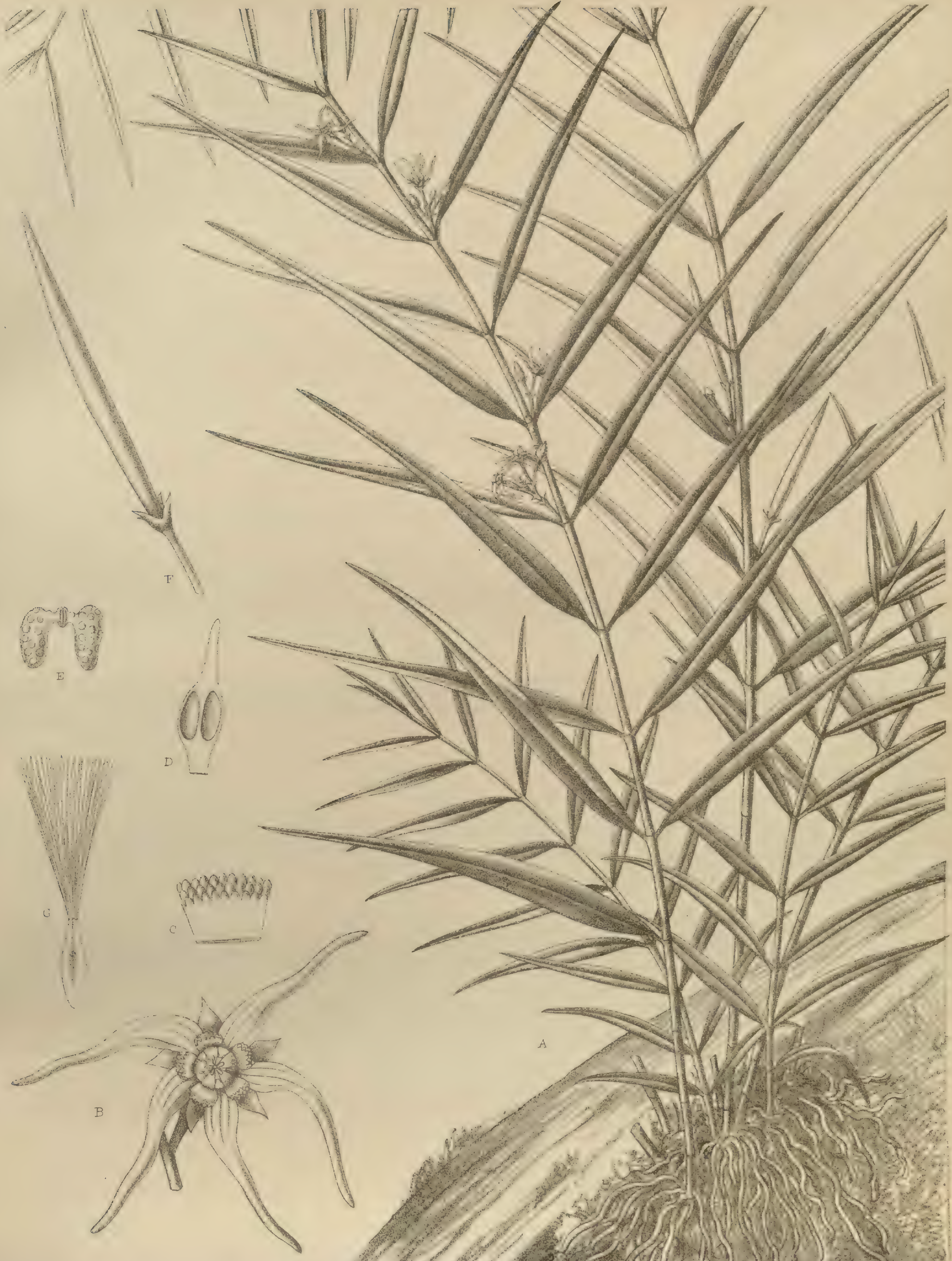
West, Newman imp.



J. T. Alves ex secc.
F. Morgan lith.

West, Newman imp.

GEOPHILA MELANOCARPA.



J. D'Alwis ex sicc.

J. N. Fitch lith & imp.

SPILADOCORYS ANGUSTIFOLIA.

Ridley

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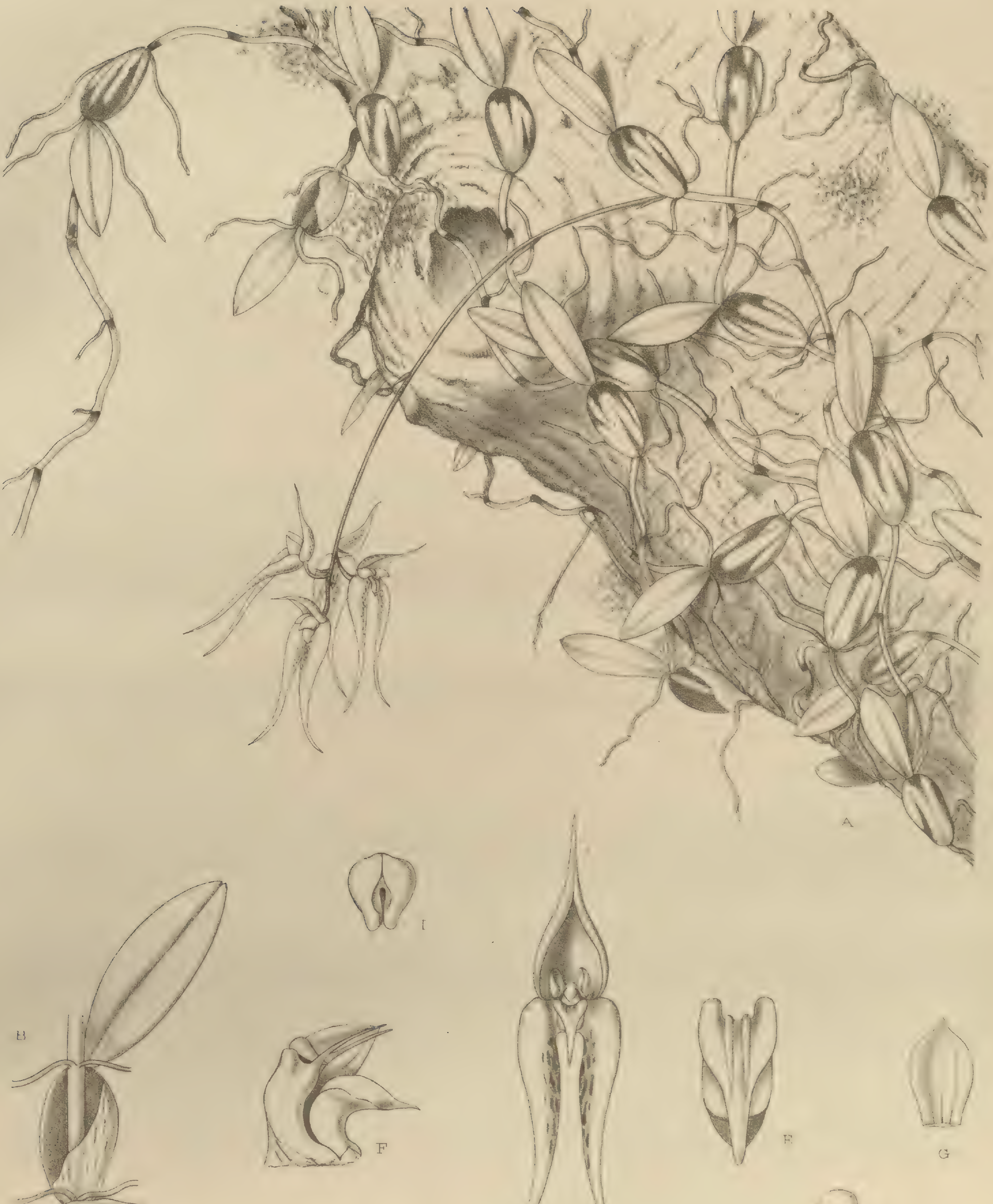

J.D'Alwis. delt.
R. Morgan lith.

West Newman imp.

CIRRHOPETALUM PLANIBULBE.

Ridley.

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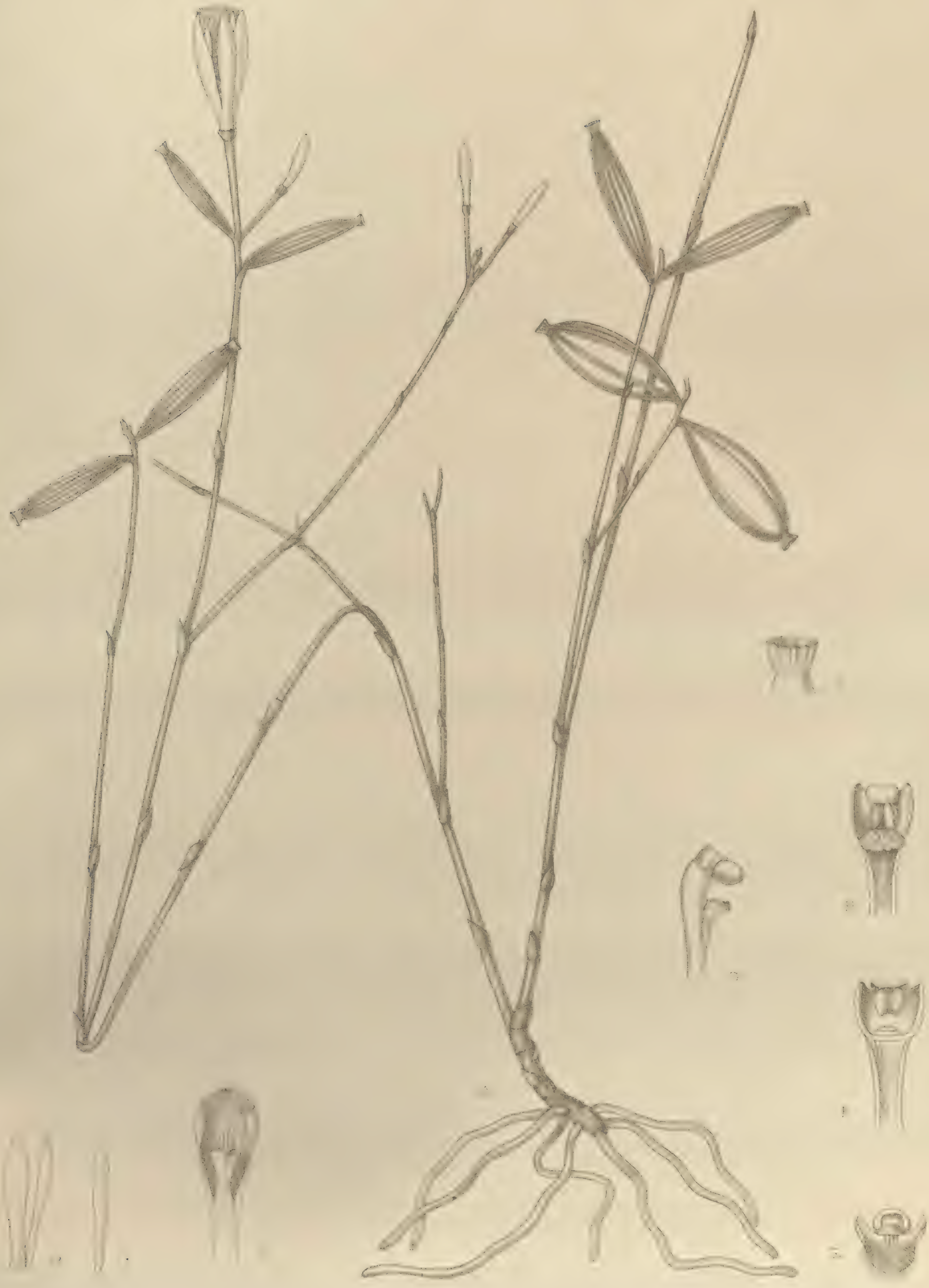
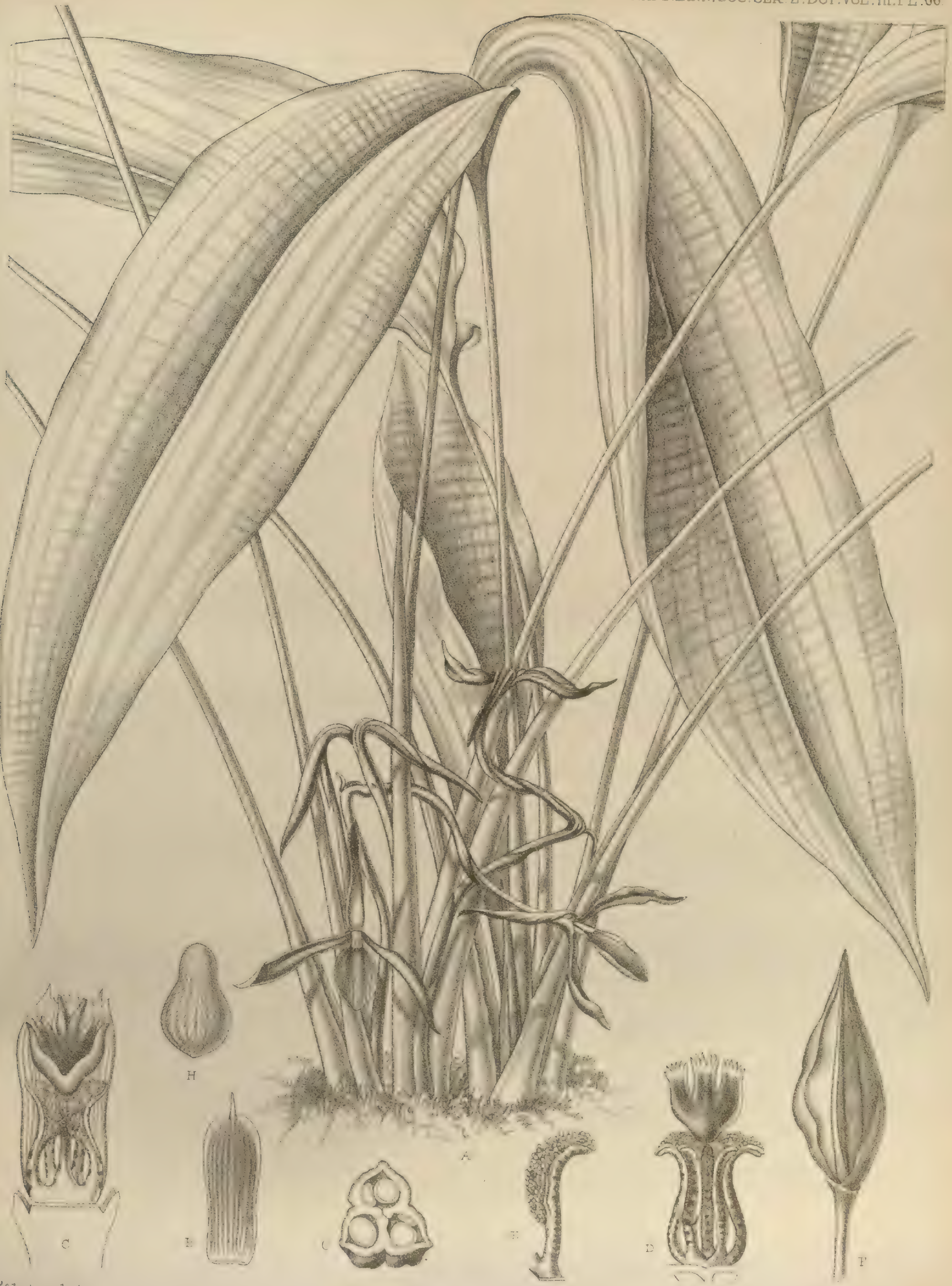


J. D. Alwis del.
F. Morgan lith.

West, Newman imp.

LECANORCHIS MALACCENSIS.



J.D'Alwis ad viv.

PROTAMOMUM MAXILLARIOIDES.

J.N.Fitch lith & imp.

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CONTRIBUTIONS TO THE EMBRYOLOGY OF THE AMENTIFERÆ.—PART I.

BY
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XI. *Contributions to the Embryology of the* Amentiferæ.—Part I. *By* Margaret Benson, *B.Sc., Marion Kennedy Student, Newnham College, Cambridge. (From the Botanical Laboratories of University College, London, and of the University of Cambridge.) (Communicated by Prof.* F. W. Oliver, *M.A., D.Sc., F.L.S.)*

(Plates LXVII.-LXXII.)

Read 15th June, 1893.

In November 1891 Professor F. W. Oliver suggested that I should investigate the embryology of the British Amentiferæ. He had on several occasions expressed his regret that such an interesting group of plants should be comparatively neglected by the botanist, and on the appearance of Treub's magnificent treatise on *Casuarina*[*] the need became more urgent. The work has been throughout conducted under his guidance, although it has been latterly carried on in a Research room kindly allotted to me in the University Botanical Laboratory, Cambridge, by Mr. F. Darwin.

The onerous nature of the investigation will be understood if one recalls the long list of genera which are grouped together under the somewhat elastic term Amentiferæ, which I will use in the present paper as including the Cupuliferæ, Coryleæ, Betulineæ, Juglandaceæ, and Salicineæ.

There was little material in hand; but during the spring and summer of 1892 I collected complete series of the female flowers of representative species of eleven genera, and of many I have been at no little trouble to obtain parallel series of different species.

The flowers were always preserved in absolute alcohol, although occasionally in picric or chromic acid also. There is but little literature to guide one as to the date of the important stages, even if such particulars could be of much use in a climate like ours; and the styles having withered often for months, the result was that very frequent gatherings had to be made long before the actual processes occurred which were sought. Fortunately it is tolerably easy to obtain good results by the examination of fresh material, although in the most critical periods the difficulty was increased by the large number of ovules that normally abort, for repeated preparations had to be made before one could rely on the ovules being such as were continuing their development. The result has been that, although over two hundred bottles of material were collected, and unremitting attention was given from March until September, I am still obliged to rely on this year's material (*i. e.* 1893) for a stage of development in two or three cases. Lastly, the flowers belonging, for the most part, to our forest trees, which bear their fruit chiefly on their upper branches, was another serious impediment to the proper progress of this research.

I adduce these particulars merely to explain the great length of time that has elapsed since the task was undertaken, and as some apology for the fragmentary nature of this first instalment of my results.

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[*] M. Treub, "Sur les Casuarinées et leur place dans le Système Naturel," Ann. du Jard. Bot. de Buitenzorg, x. pp. 145–231.

Examination of the fresh material was, as I have said, made as far as possible when it was gathered, and, although the exceeding delicacy of manipulation required of an embryologist, if trustworthy results are to be obtained, could scarcely be called into play when material was accumulating so fast, I soon found myself in contact with new and interesting forms which I had never met with before. It seemed advisable that I should ascertain the whole course of development of the embryo-sac and its contents in at least one particular group of genera and thus be sure of my ground in one connexion. I chose the Cupuliferæ, which, although more normal in many respects than some other groups, will prove, I think, on further description, to be an interesting point of reference when we pass to others.

CUPULIFERÆ.

This group is referred to in the 'Genera Plantarum' of Bentham and Hooker as the Quercineæ, under which name are placed the four genera *Quercus*, *Castanopsis*, *Castanea*, and *Fagus*. For embryological purposes it appears to me best to give some account of *Fagus* first.

Fagus. (Pl. LXVII. figs. 1–11; Pl. LXVIII. figs. 12, 13.)

The species selected for observation was *Fagus sylvatica*, Linn., and to this I refer by its generic name simply. Early in April we can just distinguish the buds which contain the young flower-heads from the less bulky leaf-buds. If the young female flowers are now examined we find the ovules are already laid down, and rudiments of the inner integument are seen to be forming, partly at the expense of the epidermis. Simultaneously one or more contiguous epidermal cells at the apex of the young nucellus divide by periclinal walls. While this is taking place there is differentiated immediately below them a layer of subepidermal cells, generally from three to six in number, as seen in a longitudinal section, which forthwith begin to divide by parallel straight walls in the same manner as the apical epidermal cells, *i. e.* periclinally (figs. 1, 2).

Although nearly the whole of the nucellus is constructed from these two layers, only the central strands maintain the regular mode of division and become strongly marked out from the peripheral tissue. In a transverse section this core of the nucellus generally separates from the surrounding tissue and leaves a ring of nucellar tissue within the double ring of the transversely-cut integuments. As development proceeds the epidermal cap spreads over the whole upper surface of the nucellus and grows to be about thirteen cells deep, thus forming nearly a third of its bulk (fig. 9, *e.p.*).

The central strands of the nucellus, as follows from what has been said, extend down to the level of the insertion of the inner integument, and are composed of large prismatic cells—often hexagonal in transverse section, and, especially in the central regions of the nucellus, elongated in the direction of its axis. It not unfrequently happens that in one strand certain partition-walls are delayed in development, and thus we get one long cell corresponding to a tier of three or more cells. These long cells are often crowded out (fig. 10, *l.c.*). It seems, however, that, at least occasionally, the embryo-sac may arise in this manner (fig. 8, *l.c.*). This central series of coaxial strands appears to be "sporogenous tissue," although it is very rare in *Fagus* to find more than one cell continuing its development, though such a case is shown in fig. 9, *e.s.*, *e.s.* I have not been able to trace the organic base of these axial strands in material gathered later than May 14, ten days after the date of the ovule drawn in fig. 3. In the case referred to, the tendency to develop one strand more prominently than the rest, which we sometimes observe even in *Fagus*, is shown by the semi-diagrammatic figure (fig. 5), which should, however, be contrasted with that given in fig. 6.

The embryo-sac most frequently develops from a cell that lies about fourth or fifth down from the epidermal cap. There is no other mark by which to distinguish it from its sister cells above and below it in an axile row than the formation of the two nuclei which take up their position at either end of the cell (fig. 7, *e.s.*). But we may, perhaps, from analogy with other Angiosperms, tentatively regard the cells intervening between it and the epidermis as tapetal.

Pollination occurred on May 9, just three weeks before the pollen-tubes reached the embryo-sac. On May 24 the ovarian cavity was crowded with branching pollen-tubes, three or four of which have been seen to enter a micropyle simultaneously (fig. 11). They enter the epidermal cap and make their way to the apex of the embryo-sac. Here one was observed to penetrate for a short distance between the two synergidæ which abutted on the apex of the sac, but I have not succeeded in observing the transfer or even presence of the male nucleus. The converging tiers of cells of the epidermal cap are doubtless of service in directing the course of the pollen-tube, and their marked turgidity is probably also advantageous, for the cells collapse and flatten after fertilization has taken place. Fig. 12 shows a pollen-tube plunging between these receptive cells.

The embryo-sac presents nothing abnormal up to the period of fertilization. At this time the antipodals acquire a thick cellulose wall, and are thus prevented from entering the cæcum, which is now extruded from the base of the sac. The definitive nucleus enters this cæcum, which sometimes reaches to the base of the nucellus, taking its course down one of the tiers of cells already described (fig. 13).

To sum up:—*Fagus* is normal in the structure of its embryo-sac and in the course taken by the pollen-tube. Its sporogenous tissue agrees far more with Strasburger's well-known description of *Rosa livida* than with Treub's account of *Casuarina*, and the cæcum is only formed on, or shortly before, fertilization.

CASTANEA. (Pl. LXVIII. figs. 14–21; Pl. LXIX. figs. 22–27.)

The species examined has been *Castanea vulgaris*, Lam. (*C. sativa*, Mill.), and to this I refer when employing the generic name. The appearance of the young nucellus is best understood by a reference to fig. 14. Essentially the same structure obtains as in *Fagus*, but the lateral strands no longer, in their early stages, suggest a sporogenous tissue. The central strand of five to eight cells is obviously the archesporium. The two to four upper square cells, the uppermost of which abuts immediately on the epidermis, appear to be very evidently tapetal. The embryo-sac lies immediately below them, and we find two sister cells continuing the row, which I have several times observed to be bi-nucleate (fig. 18, *b.c.*). Occasionally these cells undergo further division, as is shown in fig. 20, *ax.* They enlarge and compress the neighbouring cells, some of which may be observed to resist the pressure and become spindle-shaped, and occasionally bi-nucleate, themselves, but it is difficult to discriminate between a nucleus breaking down in process of degeneration and an active one when the cells are surrounded by a degenerating tissue. It is, however, important to bear in mind that small spindle-shaped cells appear around the base of the axial strand, and are formed sometimes by divisions arising obliquely in this row, and apparently sometimes by secondary modification of members of the immediately contiguous lateral strands. They are generally at first smaller than their neighbours, although some are destined later to undergo a strikingly new development (figs. 16, 17).

Meanwhile the cell about to become the embryo-sac has enlarged. Its nucleus has divided into two and then into four in a manner entirely normal. Later on the polar nuclei fuse and form an exceptionally large and conspicuous definitive nucleus (fig. 21, *d.n.*) which is connected with other contents of the sac in all directions by anastomosing moniliform strands, often of great tenuity. As previously described, in *Fagus* this nucleus passes into the cæcum, which is now extruded. In *Castanea* the cæcum breaks its way through the side-wall of the nucellus near its apex, and runs down between the long cylindrical nucellus and the inner integument (fig. 20) and very quickly reaches the base of the nucellus. The antipodals are consequently not thrust to one side, and they arrange themselves in a tier as shown in fig. 21, *a*. It is around this pointed organic base of the embryo-sac that we first observe the appearance of small tracheïdes, one or more of which ultimately reach a considerable size and become remarkably conspicuous objects under the microscope. As these at once suggest an homology with the tracheïdes in the sporogenous tissue of *Casuarina* as figured by Treub* in plates xix. and xx., I have given several drawings of them (figs. 21–27). It is by far the commonest result in a longitudinal section to find but one tracheïde; indeed fig. 22 represents the only preparation I have obtained that shows a complete and symmetrical arrangement of such tracheïdes around the antipodal extremity of the embryo-sac. Their function is as unaccountable to me as that of the tracheïdes in *Casuarina* was to Treub; but I do not think we can doubt their homology when we bear in mind the undoubtedly sporogenous nature of the tissue surrounding the embryo-sac in *Fagus*, and the great structural resemblance of the nucellus of *Castanea* to that of *Fagus*. Moreover, they are never found *outside* the well-marked degeneration-area which extends for a short distance down the centre of the nucellus, and they appear to carry on their development even when the embryo-sac, as in many of the abortive ovules, has ceased to expand. The whole character of these tracheïdes is so distinct from that of any other cells in the nucellus, whether of *Fagus*, *Quercus*, or *Castanea*, that I have little hesitation in regarding them as a vestige of some long-lost structure. But the strongest evidence in support of this claim lies in a comparison of the spindle-shaped cells, and their later stages as tracheïdes, with the long, narrow, pointed cells about to be described in the case of *Carpinus* (Pl. LXXI. fig. 48, *s.*). We see there the coaxial system of strands is almost completely merged in one part of its course into a mass of these long pointed cells. The only suggestion of these that we find in *Fagus* is the tendency of the walls in the lower regions of the strands to be more or less oblique instead of exactly transverse—as are the walls which give the characteristic appearance to the upper part.

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* Ann. du Jard. Bot. de Buitenzorg, x.

The *Castanea* material I have worked upon was gathered in the East of England and gave very unsatisfactory results in the later stages. I hope this year to obtain material from a district in which this species is better able to carry on the development of its fruit. Judging, however, from flowers gathered from August 6, when I first find the tracheïdes appearing, until August 22, I should be inclined to say they are not constantly present. A complete series of sections of an ovule cut with the microtome often reveals no trace of a tracheïde, and this inconstant appearance supports the view that they are vestiges of some former structure.

QUERCUS. (Pl. LXIX. figs. 28, 29.)

This genus has not afforded me anything distinctive to relate. It closely resembles *Castanea* in the structure of the nucellus, although this never attains the great length that is so characteristic in *Castanea*. The axial strand, the position of the embryo-sac in this, all the processes in the embryo-sac—including the extrusion of the cæcum (fig. 29, *cæ.*)—and the arrangement of the antipodals in a pointed base, can be readily demonstrated to be similar. I have been able to verify Hofmeister's observations on the course of the pollen-tubes, several of which enter and descend a single micropyle. The pollen-tubes form short blind branches as shown in fig. 28, *c.*, *c.* The embryo, being attached to the apex of the extruded embryo-sac, is to be seen lying almost in the micropyle up which the embryo-sac pressed before fertilization.

CASTANOPSIS.

This genus still awaits investigation, but I hope soon to have the material in hand. The fruit takes two years to develop, as is well known to be the case with *Q. rubra*, *Q. Cerris*, and many other species of *Quercus*.

On leaving the Cupuliferæ we enter upon the examination of two groups of the Amentiferæ which, so far as yet investigated, reveal a striking phenomenon in the abnormal course of the pollen-tube, which does not enter the micropyle, but penetrates the nucellus from the chalazal region. This exceedingly interesting fact was first noted by Treub for the case of *Casuarina*. I hope now to show that it also occurs in *Betula* and *Alnus*, *Corylus* and *Carpinus*, and I will refer to this group of genera by the distinguishing name of "Chalazogamic Amentiferæ." The whole account of the course taken by the pollen-tube, and other associated topics, will be found further on, but I will first give a short description of the embryology of representative species of each genus.

BETULA ALBA, Linn. (Pl. LXIX. figs. 30, 31.)

The structure of the young nucellus can be seen from the longitudinal section represented in fig. 30. We see again the coaxial system, the archesporium abutting on the epidermis, and this epidermis two-layered as in an early stage of *Fagus*. It is the more interesting to note this resemblance, as in a short paper published March 1893, but which I unfortunately overlooked until the middle of May, the writer expressly states, "In the nucellus there is no axial row of cells, which usually appears distinctly in the rest of the Angiosperms" *.

The central axis gives rise eventually to the embryo-sac, which is solitary and at no time in its development forms a cæcum. The contents of the sac are normal, and the egg-cell is ready for fertilization at the end of May. In the material gathered in the season of 1892, pollination took place during the first week of May and fertilization during the first week of June. The nucellus never attains to anything but a very inconsiderable size, as the whole fruit is adapted for wind-dispersal. The ovules given in longitudinal section (figs. 30 and 31) lay at right angles to the axis of the fruit, but before an ovule attains its full development it becomes anatropous, and the stylar canal is closed by the outgrowth of loose cellular tissue. These organogenetic details being common to the other chalazogamic Amentiferæ, and deriving their interest for the embryologist chiefly from their bearing on the course of the pollen-tube, I will enter into them more fully when treating of that subject.

ALNUS GLUTINOSA, Medic. (Pl. LXIX. figs. 32, 33; Pl. LXX. figs. 34–38.)

The coaxial system of strands still obtains in the nucellus of *Alnus*. The tapetum above the solitary embryo-sac is proportionately longer than in *Betula* and in the Corylaceæ. The embryo-sac lies very deep down in the nucellus, and the tapetum, down which for a considerable part of its course the pollen-tube travels, has a grumous aspect. It is not, perhaps, an improbable conjecture that the cells exert a chemical stimulus upon the tube which enables it to arrive at the apex of the sac after a very sinuous course. The contents of the embryo-sac are normal (fig. 33), and the antipodals resemble those figured by Treub for *Myrica* rather than those of *Castanea*, although there is no essential difference, and in all cases cellulose walls are conspicuously present. I have given a figure of the embryo of *Alnus*, which is again normal (fig. 37).

CORYLACEÆ.

In this group we meet with a far more strongly-developed sporogenous tissue than in *Betula* and *Alnus*, although it much resembles theirs in character.

In *Corylus* and *Carpinus* we find for the first time among the British Amentiferæ a large number of macrospores which continue their development up to the stage of forming two or even four nuclei. In those which continue their development the characteristic contents of the normal angiospermic embryo-sac are present, but the synergidæ and antipodals are difficult to recognize, except when first formed. The egg-cell is always a prominent object in the upper region of the sac, whilst the definitive nucleus, in a well-developed cæcum of the sac of *Carpinus*, attains a large size, reminding one of those of *Castanea*.

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* "Zur Embryobildung der Birke," by S. Nawaschin, in Bull. Acad. Imp. Sci. St. Pétersb. sér. iii. xxxv. no. 3. In this paper Mr. Nawaschin records his discovery of the true course of the pollen-tube in *Betula*.

CORYLUS AVELLANA, Linn. (Pl. LXX. figs. 39–43; Pl. LXXI. figs. 44–47.)

In this genus we find much that is new and of interest to the embryologist. Although the sporogenous tissue is based on the coaxial system, and the strands are particularly clearly marked out in the tapetal region, there is less regularity in the region immediately above the pedicel. The cells are there smaller and more granular, and several early show signs of further development. The sections given in figs. 41, 42, 43 were prepared in June and July 1892 from the fresh material. In fig. 42 one embryo-sac had separated from the section, and its position is indicated only by a gap in the nucellar tissue (*p.e.s.*). Later on, one of these embryo-sacs sends out a protuberance which passes down towards the base of the nucellus. Figs. 46 and 47 represent a cæcum with a pollen-tube abutting upon it. Figs. 44 and 45 also represent a pollen-tube—*in situ*—passing up the nucellus from the chalaza. The cæcum attains considerable length only when the embryo begins to develop. In this, *Corylus* offers a striking contrast to *Carpinus*.

On two occasions I have found two fully-developed embryo-sacs, and in these cases they elongated side by side. The egg-cell covers itself with a cellulose wall and becomes attached to the apical part of the wall of the sac. The synergidæ never become so large and conspicuous as those of the Cupuliferæ.

CARPINUS BETULUS, Linn. (Pl. LXXI. figs. 48–50; Pl. LXXII. figs. 51–60.)

There is much that is similar to *Corylus* in the early stages of *Carpinus*. Fig. 48 shows the area of the sporogenous tissue and pedicel as marked out in a longitudinal section. The embryo-sacs arise chiefly from the central strand, and two or more take on a full development and send long cæca down to the base of the nucellus. In fig. 49 only one of these is indicated, fig. 54 shows two, and fig. 53 four; but it is rare to find the cæca quite in the same plane. These cæca are best seen in a comparatively thick section of the nucellus, which is composed of remarkably large and transparent cells in *Carpinus*. Such a section sometimes reveals a nucellus riddled by these tubes, which necessarily come into close contact at the narrow base of the nucellus. These tubes reach their full length before any endospermic nuclei are formed, and the definitive nucleus is conspicuous in the cordon of protoplasm which reaches from the apex to the base of the embryo-sac. It is by means of these dense continuous tongues of protoplasm that we can best trace the course of the cæca in *Carpinus*, and it is along these that I have on several occasions traced a pollen-tube, which, after entering the base of the cæcum, makes its way to the egg-cell. Fig. 50 shows one still persisting after fertilization has occurred.

The Pollen-tube.

This subject may be advantageously treated under the three headings of

Resting Stage,
Chalazal Route,
Branching of the Tube.

Resting Stage.—In Goebel's 'Outlines of Classification and Special Morphology,' I find on p. 392 of the English edition the following statement, which, I think, is calculated to give an erroneous impression respecting the process of fertilization in *Quercus* and *Fagus*:—"Fertilization is usually accomplished in a very short time after the pollen-tube reaches the apex of the embryo-sac, yet the cases are not few in which a long time elapses between the arrival of the pollen-tube and the commencement of the development which it excites—several days or weeks in woody plants, as *Quercus*, *Fagus*, &c.; almost a year in the American oaks, which take two years to ripen their seed."

It is here implied that the pollen-tube does not enter on its resting stage until it reaches the embryo-sac, whereas the organogenetic researches of Baillon show that in *Quercus* no vestige of the ovule is present at the time of pollination, and I have failed to demonstrate the presence of tubes in the stylar canal or ovarian cavity until the period of fertilization approaches. The tubes remain latent during the four months that the ovary is developing in the case of such a species as *Quercus Robur*, which ripens its fruit in one year; but for so long a period as eleven months in other species of *Quercus*, which take two years to ripen their fruit. The case is very similar in the Betulineæ and Corylaceæ.

In the material which I have examined gathered in 1892, the pollen-tubes remained in a resting stage in the case of *Corylus* from February 5 until June 21, *i.e.* over four calendar months; in the case of *Carpinus*, from May 6 to July 1, nearly two months; in the case of *Alnus*, from March 23 to June 17, nearly three months; and in the case of *Betula*, from May 6 until June 8, one month.

The case of *Fagus* is particularly easy to investigate. The ovule represented in Pl. LXVII. fig. 4 represents the stage reached when pollination occurred on May 9, but no pollen-tubes could be found in the cavity of the ovary until May 21, when they were observed descending from the stylar canal in great numbers, and the rapidity of their growth was also curiously manifested by a chemical reaction that occurred in material gathered and pickled during the week beginning May 21. Large crystals of calcium oxalate were deposited on the interior wall of the ovary around the ovules, and often even on the free pollen-tubes as they left the stylar canal and entered the larger cavity of the ovary. But even on May 24 no pollen-tube had reached the nucellus. Three days were required by them to find their way down the very long micropyle. The tunnelling of the epidermal cap was accomplished only on the last two or three days of May. The embryo begins to elongate almost immediately on the pollen-tube reaching the embryo-sac, examples having been found of the various stages in material gathered on the same day.

In order to investigate whether anything unusual occurred in the young pollen-tube which would render it specially fitted for so long a resting stage, I made several cultivations of the pollen-grains of *Carpinus* and found that they germinated very freely, thrusting out the intine at one of the five specially-prepared spots.

For two days elongation occurred, and then a thickening of the apical region took place, and this distal part of the tube became enlarged (Pl. LXXI. figs. 46 and 47). Into this there passed two nuclei, and the tube not only became plugged at its point of junction with the grain, but also I observed it once or twice to be again plugged immediately above the enlarged tip, which thus became virtually an isolated spore like a pollen-grain, which, though it had lost its outer coat, would in the normal state of things be safely housed or encysted in the tissue of the style.

After observing this result of germination of pollen-grains, I was in some doubt as to how far it might be merely a pathological arrest of growth. I treated a number of fairly thick longitudinal median sections of the ovary of *Carpinus* with H_2SO_4 in the hope that maceration of the surrounding tissue would bring into view any trace of the pollen-tubes in the stylar cylinder. Figs. 59 and 60 (Pl. LXXII.) represent one of these macerated sections, taken from material gathered July 1st, 1892; but I have as yet failed to obtain further evidence for the existence of a secondary pollen-grain or portion of tube encysted in the tissue of the style.

Chalazal Route.—Leaving now the subject of the resting stage undergone by the pollen-tube, let us turn to a phenomenon which is less universal in Amentiferæ, and, so far as is at present known, is peculiar to the three groups Casuarineæ, Betulaceæ, and Corylaceæ. I refer to the route taken by the pollen-tube to gain access to the embryo-sac.

Schacht, writing just forty years ago, claims to have observed a portion of the pollen-tube in the nucellus of *Corylus*. He writes: "Several times have I seen in successful longitudinal sections a tubular cell in the tissue of the nucellus, which was united with a racemose body of cells lying in the apex of the embryo-sac. The tubular cell, *cut off above*, is the penetrated pollen-tube"[*].

Here Schacht had probably made a very similar observation to that recorded by Hofmeister[†] in 1858 when he said, respecting *Betula* and *Carpinus*, that the cell-layers covering the apex of the sac are tunnelled by the pollen-tube. This statement has been a fruitful source of error.

Treub quotes the passage as sufficient evidence for the normal course being pursued by the pollen-tube in these trees, and did not consider it necessary to investigate the matter further, although, as it appears, such a step would have led him to conclusions wholly different from those he drew from the literature on the subject.

The pollen-tube does indeed in some instances (e. g. *Alnus*) tunnel the cell-layers which cover the apex of the embryo-sac, but it has, in such cases, reached these cell-layers by a route wholly as abnormal as Treub has pointed out in the case of *Casuarina*. It descends from the tissue at the base of the stylar rudiments and, running parallel with the vascular bundle of the raphe, turns abruptly up into the nucellus on reaching its chalazal region (Pl. LXX. fig. 38). The base of the nucellus will be observed to lie in such a direction (figs. 32 and 34) that the pollen-tube following the trend of the cells in the neighbourhood of the vascular bundle of the raphe cannot fail to find its way into the nucellus. This position of the base is gradually acquired by unequal growth of the

[*] 'Botanische Zeitung,' 1854: Schacht, "Beiträge zur Anatomie" &c. The "racemose body of cells" of the quotation refers probably to a group of three or four embryo-sacs which lie near the apex of the nucellus. The "tubular cell cut off above" I think very likely not a pollen-tube, but one of the long tapetal cells so frequently found in this region, and often strikingly suggestive of bits of old pollen-tubes. On the whole I cannot accept Schacht's statement as evidence for the presence of a pollen-tube in this position.

[†] Pringsheim's 'Jahrbuch,' 1858: Hofmeister, "Embryobildung der Phanerogamen."

two halves of the ovule which cause the very characteristic curvature of the ovules of *Alnus, Betula, Corylus,* and *Carpinus.* The position is strongly contrasted with that of *Fagus* and *Quercus,* although these ovules are also anatropous; but, at the same time, resembles what, from Treub's figures, we observe to be the case in *Casuarina* (plates xxii. and xxiv.)[*].

From the difference in the one case and the agreement in the other we are, I think, entitled to regard this feature as a special adaptation for chalazogamy.

I have given two figures of pollen-tubes in contact with the base of the embryo-sac cæca (*Corylus* and *Carpinus*). In the case illustrated by figs. 46 and 47 (Pl. LXXI.) we find the tube abutting on the comparatively short cæcum of *Corylus.* In figs. 44 and 45, which also exhibit the tube ascending the nucellus, the lower part of the tube alone is represented.

In figs. 55 and 56 (Pl. LXXII.), which illustrate a similar case in *Carpinus,* contact has taken place quite at the base of the nucellus. These instances, and especially the perforation of the wall of the embryo-sac at the spot abutted upon by the pollen-tube, as shown in fig. 55, prepare us for the next stage, which we see delineated in figs. 50 and 51. The pollen-tube enters the base of the fertile embryo-sac in *Corylus* and *Carpinus,* and, continuing its course up the whole length of the cæcum, eventually reaches and fertilizes the oosphere by direct contact. Whether this has already surrounded itself with a cell-wall or not I have not conclusively determined, although many of the preparations so far made suggest this to be the case, as I have repeatedly found a unicellular egg-cell clothed with a cell-wall where I have failed to demonstrate any vestige of a pollen-tube; and yet fig. 50 proves it capable of persisting until the oospore has twice divided. The inconspicuous development of the synergidæ and their early dissolution are now explained. They are not required to assist in any way the act of fertilization, for the pollen-tube reaches the oosphere from below, having previously entered the embryo-sac in its basal region.

Fig. 32 taken with fig. 34 (Pl. LXX.) has enabled me to construct the course taken by the tube in the nucellus of *Alnus* as given in the diagrammatic drawing, fig. 38. From the chalaza it runs up more or less by the tiers of large cells which constitute the stalk-like prolongation or pedicel (Treub) of the sporogenous tissue already described. It leaves this, and ascends to a level considerably above the apex of the embryo-sac, and then, turning down again, presents the appearance of a tube pursuing a normal course. It was doubtless this last part of the course that was observed by Hofmeister.

Branching.—The pollen-tube presents another point of likeness with that of *Casuarina,* inasmuch as it sends out a short recurved branch on entering the nucellus (fig. 36, *b.*).

This branching of the pollen-tube is a very general feature in the Amentiferæ. Even in those genera in which we do not find the chalazal course of the tube, we find a process of bifurcation still very widely present. Schacht, in the above-mentioned paper, gives drawings of the pollen-tubes of *Fagus.* I include a figure of the tubes of *Quercus* (Pl. LXIX. fig. 28). The character of the branching is, in *Fagus,* the simple bifurcation of the tube into what appear to be equivalent tubes, but in the case of the chalazogamic

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[*] Treub, *loc. cit.*

Amentiferæ the recurved branches found are simply cæca and probably contain no portion of the fertilizing element.

There are several cases of branching pollen-tubes recorded by Hofmeister among the Monocotyledons in the 'Neue Beiträge zur Kenntniss der Embryobildung der Phanerogamen,' 1861. The branched tubes of *Pothos longifolia* are represented in Taf. x. figs. 1 and 2, and those of *Hippeastrum aulicum* in Taf. xiii. figs. 4 and 6. But more interesting examples of the branching of pollen-tubes occur among the Gymnosperms, where we find in the Cupressineæ one tube applying its broad extremity to the necks of a whole group of archegonia at the same time, and then forming short narrow protuberances which grow down into the separate archegonia.

Comparative account of the Archesporium in the foregoing Genera.

We find in reviewing the various examples described in the preceding pages certain features in their archesporium which they have in common, not only with one another, but with the normal type which has been shown by Strasburger and others to be almost universal among the Angiosperms.

Thus we observe in all eight genera the subepidermal origin of the archesporium and also the presence of tapetal cells. Again, the archesporial cells are arranged in strands, formed at first of definite tiers of cells cut off from their respective initial subepidermal cells. But whereas in the normal Angiospermic type we find but one of these strands, which is therefore named "the axile row," in the genera now under consideration we find a large number of these rows derived from a subepidermal layer, and it is difficult in many cases to point out one row as more distinctly characterized than some others (Pl. LXVII. fig. 8, Pl. LXXI. fig. 48). This system of strands, forming what I have previously referred to as a *sporogenous tissue*, is connected with the base of the nucellus by a regular series of cells which I have referred to as the *pedicel* of the sporogenous tissue.

Again, we find oblique divisions occurring in the cells of this coaxial system of strands which lie between the tapetum and the pedicel of the sporogenous tissue. The spindle-shaped cells thus arising, in the case of *Castanea*, develop into large and conspicuous tracheïdes, but it is chiefly in the Corylaceæ that they become a marked feature, though they do not form tracheïdes. Without trespassing too far into the region of theory, it may be of interest to note that the sporogenous tissue of *Fagus* seems to belong to a more primitive type than we find in the other genera. This view has independent support from Eichler's opinion, who deduced from the floral morphology of the Order that the Cupuliferæ are a less specialized group than the Corylaceæ and Betulineæ. In *Fagus* also there are two integuments to the ovule and a very well-developed epidermal cap. In the latter character, among others, there is considerable agreement between the nucellus of *Fagus* and those of *Gnetum*, *Taxus*, and other Conifers. From the *Fagus* type we find, on the one hand, a reduction in the extent of the archesporium in the case of the other Cupuliferæ, until there is very little that is not normal in *Quercus*; and on the other hand, a reduction in bulk in the case of Corylaceæ, Betulineæ, and Juglandaceæ, although in Corylaceæ, especially, we can still claim for a large part of the tissue of the nucellus a sporogenous nature.

Relations of the Amentiferæ to Casuarina *as revealed by Embryology.*

This part of my subject cannot be dealt with exhaustively until further and deeper researches have been made. The agreement I have to point out is so mixed up with striking distinctions that we cannot, so far as our knowledge at present extends, in any way claim to have found a counterpart in our British Amentiferæ to the extraordinary facts recorded by Treub for *Casuarina*. We know nothing of an embryo-sac without antipodals, for they are present and very conspicuous in the British Amentiferæ. In *Betula*, *Alnus*, and the Cupuliferæ I have observed the fusing of the polar nuclei, and in every genus the presence of synergidæ and *naked* egg-cell. But Treub concludes his paper with the words :—"A moins que de nouvelles recherches ne viennent nous apprendre le contraire, il faut considérer la famille des Casuarinées comme la seule de la classe des Chalazogames." These new researches have now been made, and it will be no longer possible to classify the Casuarineæ by themselves as Chalazogams. *Alnus*, *Betula*, *Corylus*, and *Carpinus* are also Chalazogams, and if we except the distinctions I have just pointed out in the early stages of the embryo-sac, almost all we have to record are, more or less, points of agreement. It will be convenient here to summarize the points of agreement between *Casuarina* and the British Amentiferæ :—

1. In the case of the Corylaceæ and Betulineæ there is the prominent fact of their chalazogamy and all its concomitant adaptations. Among these I may mention the fusion of the tissue of the stylar region with the central strand, which is itself formed by the fusion of the two parietal placentæ, which have grown centripetally until they met and formed one strand, from the upper portion of which the now anatropous ovules spring (cp. figs. 39 and 40, also figs. 34 and 35, Pl. LXX.).

Another special adaptation is the projection of the base of the nucellus into such a position that the pollen-tube, after travelling down the raphe in a course parallel with that of the vascular bundle, and following the trend of the cell-rows in the chalazal region, inevitably enters through the circular base of the nucellus (figs. 32, 34). We also see the sheath of crystals, which is so prominent a feature in *Casuarina*, although it would appear that our British Amentiferæ have not specialized it to assist in the act of fertilization, as has occurred in *Casuarina* (figs. 34 and 35, also fig. 39).

2. The sporogenous tissue, already sufficiently described in another paragraph, although presenting striking points of difference in detail from that of *Casuarina*, constitutes, in the main, an important point of agreement.

3. The branching of the pollen-tube, especially the formation of recurved cæca before its entry into the nucellus in the chalazogamic genera, and the resting stage that it passes through in the stylar tissue may, perhaps, be mentioned here.

4. The prevalence of cæca formed by the embryo-sac is a remarkable feature of agreement. This character is so widely represented in the British Amentiferæ that it may fairly be regarded as of taxonomic value. The fact that the tails of the sterile macrospores in *Casuarina* serve for the unimpeded pathway of the pollen-tube up the nucellus, while that of *Fagus* is simply foraging for the needs of its embryo, only offers another example of the special adaptation to new functions of an organ already acquired by

inheritance. Whether the cæca were originally acquired to assist the embryo-sac to come in contact with the pollen-tube or for foraging purposes is immaterial from the present point of view. Physiological considerations in no way detract from the classificatory value of these cæca.

5. The presence of tracheïdes around the base of the embryo-sac in *Castanea* is a curious and unexpected link between the Cupuliferæ and *Casuarina*. Alone this feature might be regarded as too detached and fragmentary to be of any value as a point of agreement, but when we remember that we can suggest no function subserved by them either in *Casuarina* or in *Castanea*, and that their appearance is inconstant in both cases, the probability is increased that they represent some former organ * possessed by the common ancestor of *Casuarina* and the Cupuliferæ. It might be noted here that although the ovules of our British chalazogamic Amentiferæ possess but one integument, *Casuarina*, in common with the Cupuliferæ, possesses a second.

Conclusion.—There is still a large part of my work to be done. I have not yet relinquished all hope that the Amentiferæ are a field of research in which we may find some clue to the solution of the vexed problem of the homology of the antipodals and of the fusion of the polar nuclei of the embryo-sac, and it will be partly with this object in view that I continue and extend my investigations.

DESCRIPTION OF THE PLATES.

PLATE LXVII.

Fagus.

Fig. 1. A longitudinal median section of young ovule of date May 4, 1892. *ep.*, the beginning of the apical divisions of the epidermis above the archesporium; *a.*, archesporium mother-cells; *i.*, integument forming partly at the expense of the epidermis.

Fig. 2. A similar section to the above. This figure shows, when contrasted with the previous, the early laying-down of the anatropy of the ovule. The funicle of fig. 1 lies to the right of the figure, that of fig. 2 to the left.

Fig. 3. The same a little later. *ep.*, the beginning of the epidermal cap; *a.c.*, the lowermost cell of the most strongly differentiated axial strand. The two nucleoli are very frequently found in central cells at this stage.

Fig. 4. The same at a still later date, May 10, 1892. The epidermal cap is here five cells deep.

Fig. 5. A median longitudinal section of nucellus of date May 14. The central strand was more clearly marked out than the lateral ones and showed a pointed base. (Semi-diagrammatic.)

Fig. 6. Ditto, but lateral strands appear of equivalent value. (Semi-diagrammatic.)

Fig. 7. Ditto, gathered May 21. *ep.*, epidermal cap now ten cells deep; *e.s.*, first division of nucleus of embryo-sac.

Fig. 8. Ditto, gathered May 18. *ep.*, as before; *t.*, tapetum; *l.c.*, long cell equivalent to three of the

contiguous tier—apparently marked out as an embryo-sac; *v.*, vacuole. The strands can be seen here to continue to the base of the nucellus although the section is not exactly median throughout.

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* Possibly a vascular strand connecting the chalaza with the sporogenous tissue.

Fig. 9. Ditto, gathered May 28. Shows development of embryo-sacs in *two* contiguous strands. The more advanced one (above) is nearly ready for fertilization. The antipodals have become detached by the razor from the upper part, which contains still the synergidæ and polar unclei. *ep.*, epidermal cap now thirteen cells deep; *t.*, tapetum; *e.s*, *e.s.*, embryo-sacs; *a.*, antipodals; *f.*, polar nuclei; *p.*, pedicel.

Fig. 10. Portion of the sporogenous tissue of nucellus as it appears in longitudinal section. *l.c.*, long cell being crowded out.

Fig. 11. This drawing is taken from a thick section cut in the fresh material. It shows a superficial view of apical region of epidermal cap, the cells of which are turgid; between these plunge three pollen-tubes (*p.t.*). *m.*, micropyle; *r.ep.*, receptive cell; *n.*, nucellus; *int.*, integument.

PLATE LXVIII.

Fagus.

Fig. 12. Longitudinal section of upper part of nucellus showing pollen-tube (*p.t.*) tunnelling epidermis (*ep.*). *s.*, synergidæ; *e.c.*, naked egg-cell.

Fig. 13. Portion of longitudinal section of nucellus showing embryo-sac with extruded cæcum. *a.*, antipodals; *d.n.*, definitive nucleus; *b.c.*, base of cæcum; *s.*, strand down which it has made its way; *e.s.*, main portion of embryo-sac.

Castanea.

Fig. 14. Longitudinal median section of nucellus, dated July 8, 1892. *a.r.*, axile row already becoming marked out from contiguous strands.

Fig. 15. Ditto, eleven days later. *t.*, tapetal cell; *m.s.*, mother-cell of embryo-sac.

Fig. 16. Ditto, July 25. *t.*, tapetal cell; *s.*, pointed cell.

Fig. 17. This section belongs to an ovule which had ceased to develop normally. The tapetal cells (*t.*) had degenerated and the appearance of the contents of the embryo-sac (*e.s.*) is not normal. *b.c.*, basal cells of axile row; *b.s.*, spindle-shaped cell.

Fig. 18. Longitudinal section showing base of axile row, also from an aborting ovule. *tr.*, mother-cell of tracheïde; *b.c.*, bi-nucleate cells of axile row below the embryo-sac.

Fig. 19. Upper part of axile row. *m.*, micropyle; *e.i.*, epidermis of inner integument; *t.*, tapetum; *n.e.c.*, naked egg-cell; *a.*, antipodals.

Fig. 20. Longitudinal section of upper part of nucellus, August 22. *m.*, micropyle; *i.i.*, inner integument; *e.s.*, embryo-sac; *d.n.*, definitive nucleus; *m.s.*, moniliform strands of protoplasm; *cæ.*, cæcum of embryo-sac; *ax.*, basal part of axile row; *s.c.*, pointed cells.

Fig. 21. Ditto. *d.n.*, definitive nucleus; *a.*, antipodals; *tr.*, tracheïde; *b.c.*, basal cell of axile row.

PLATE LXIX.

Castanea.

Figs. 22–27. Longitudinal sections of nucellus to show tracheïdes (*tr.*). *a.*, antipodal; *d.*, degenerating area; *m.*, micropyle; *e.s.*, embryo-sac; *d.n.*, definitive nucleus, faintly indicated only, as the section had been treated with Eau de Javelle.

Quercus.

Fig. 28. Pollen-tubes as found growing freely in the ovarian cavity and entering micropyle (*m.*). *o.i.*, outer integument; *c.*, cæca of pollen-tube.

Fig. 29. Longitudinal section of nucellus and part of inner integument of *Quercus rex*. *m.*, micropyle; *e.s.*, embryo-sac; *a.*, antipodals; *b.c.*, basal part of axile row; *nu.*, nucellus; *cæ.*, cæcum of embryo-sac; *i.i.*, inner integument.

Betula alba.

Fig. 30. Longitudinal section of nucellus, May 16, 1892. *a.c.c.*, archesporial central-cell dividing.

Fig. 31. Ditto a little more advanced. *a.*, archesporium.

Alnus glutinosa.

Fig. 32. Outline of upper part of long. sect. of ovary and one ovule just fertilized. *p.t.*, pollen-tube; *e.s.*, embryo-sac; *c.a.*, central axis; *lo.*, loculus.

Fig. 33. Embryo-sac of fig. 32 enlarged. *p.t.*, pollen-tube; *s.*, synergidæ; *e.c.*, egg-cell; *f.*, fusing polar nuclei; *a.*, antipodals.

PLATE LXX.

Alnus glutinosa.

Fig. 34. As in fig. 32, but here is shown the pollen-tube entering the chalazal region, also a transverse section of the tube to the right above the level of embryo-sac. *s.*, stylar rudiments; *c.*, cellular tissue; *ch.*, sheath of crystals; *p.t.*, pollen-tube; *e.s.*, embryo-sac.

Fig. 35. Transverse section of ovary taken at level of dotted line *c.c.* in fig. 34. *p.*, loose parenchyma showing no stylar canal; *ch.*, crystal sheath and lignfied tissue.

Fig. 36. Enlarged drawing of base of ovule of fig. 34. *ch.*, chalazal region; *p.t.*, pollen-tube; *i.r.*, integument (level of insertion of) on the side nearer the raphe; *i.d.*, do. on the distal side; *b.*, branch of pollen-tube.

Fig. 37. Embryo of *Alnus*, July 25, 1892. The embryo-sac has eaten its way to the epidermis of apex of nucellus. Three free transitory endosperm-cells are shown.

Fig. 38. Diagrammatic drawing of ovule of *Alnus* to show course of the pollen-tube (*p.t.*). *e.s.*, embryo-sac; *f.*, funicle; *v.b.*, vascular bundle; *m.*, the closed micropyle.

Corylus Avellana.

Fig. 39. Longitudinal section of ovary of *Corylus* before the ovule is ready for fertilization. *r.*, remnant of stigmas; *p.*, perianth; *ch.*, crystals; *pa.*, loose parenchyma; *v.*, vascular bundle now become central; *cu.*, cupule.

Fig. 40. Ditto much earlier, showing stylar canal open, and vascular bundles of placentæ still not approaching the centre. *o.*, ovule; *s.c.*, stylar canal; other letters as in fig. 39.

Fig. 41. Longitudinal section of nucellus, cut June 21, 1892. *e.s.*, embryo-sac; *t.*, tapetal region; *p.*, pedicel.

Fig. 42. Upper part of similar section. *p.e.s.*, position in which a second embryo-sac lay; *a.c.*, central strand of archesporium; *r.ep.*, rudimentary epidermal cap.

Fig. 43. As before. This section shows four embryo-sacs. The elongation of tapetal cells is often seen. *p.*, pedicel; *ep.*, epidermal sac; *e.s.*, embryo-sac.

PLATE LXXI.

Corylus Avellana.

Fig. 44. Longitudinal section of ovule showing pollen-tube ascending from chalaza. *c.*, cæcum of embryo-sac; *m.*, micropyle; *p.t.*, pollen-tube.

Fig. 45. Pollen-tube and adjacent cells in the previous fig. enlarged. *n.g.*, refringent granules, ?nucleus; *c.p.*, cells of nucellus.

Figs. 46, 47. Pollen-tube abutting on cæcum of embryo-sac.

Carpinus Betulus.

Fig. 48. Longitudinal section of nucellus (June 24th), showing area of sporogenous tissue shaded to represent the deeper-coloured granular appearance of this tissue. *s.*, spindle-shaped cells; *p.*, pedicel; *t.*, tapetum.

Fig. 49. Longitudinal section of nucellus to show cæcum of embryo-sac. *t.*, tapetum.

Fig. 50. Enlarged drawing from the preparation drawn in fig. 51. The egg-cell appears to have been fertilized, and has already given rise to a 3-celled embryo. The pollen-tube is becoming disorganized, and in the portion abutting upon the embryo has evidently given up a portion of its contents, though actual perforation of its apex could not be demonstrated. *em.*, embryo; *e.s.*, abortive embryo-sac; *f.e.s.*, fertile embryo-sac; *p.t.*, pollen-tube; *s.*, suspensor.

Plate LXXII.

Carpinus Betulus.

Fig. 51. Nucellus showing the large fertile embryo-sac with three abortive embryo-sacs (*a.e.s.*) at its micropylar extremity. Throughout the greater length of the fertile embryo-sac (*f.e.s.*) is the pollen-tube (*p.t.*), the apex of which abuts upon the small 3-celled embryo (*em.*). The chalaza is indicated by the letter *c*.

Fig. 52. Diagrammatic longitudinal median section through ovary of *Carpinus* (equally for *Corylus*) to show course of pollen-tube. *st.*, stylar cylinder; *sc.*, sclerized tissue; *pa.*, parenchyma; *pe.*, remains of perianth; *l.*, loculus; *n.*, nucellus; *p.t.*, pollen-tube.

Fig. 53. Longitudinal section of nucellus of *Carpinus*, dated July 1, showing four embryo-sacs.

Fig. 54. Ditto, more truly median. Two embryo-sacs have thrown out cæca towards base of nucellus, and one remains undeveloped in the apex of nucellus. Polar nuclei in the act of fusing shown in each cæcum. *e.s.*, embryo-sac.

Fig. 55. Base of the nucellus (shown on a smaller scale in fig. 45 *a*). *e.s.c.*, cæcum of embryo-sac; *p.t.*, pollen-tube abutting on ditto.

Fig. 56. The whole ovule on a smaller scale, from which fig. 45 was taken.

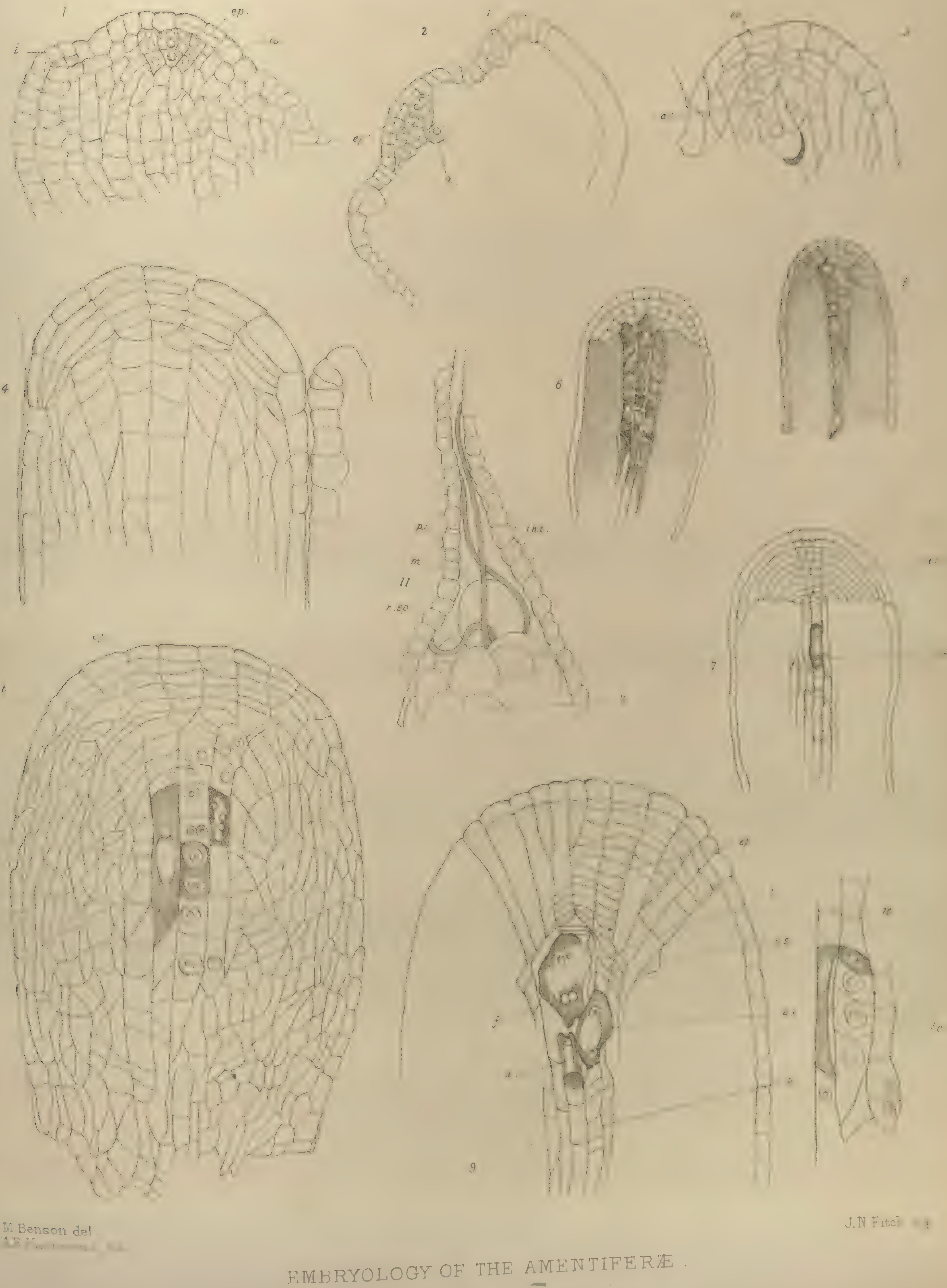
Figs. 57, 58. Pollen-grains of *Carpinus*, germinated in 5 °/₀ sugar-solution, after 4 days. *gr.*, pollen-grain; *a.*, enlargement at apex of tube.

Fig. 59. Upper part of ovary of *Carpinus* (July 1), showing the position of the (?) encysted pollen-tube. *pa.*, parenchyma; *s.*, sclerized tissue; *p.e.*, encysted pollen-tube.

Fig. 60. The encysted tube enlarged 840 diameters. *f.t.*, (?) remains of tube which was first formed from the germinating pollen-tube; *s.w.*, swollen wall after treatment with H_2SO_4; *l.*, lumen; *t.*, (?) tube about to pass down to funicle.

Juglans regia.

Fig. 61. Longitudinal median section of nucellus of *Juglans*, showing the archesporial tissue. *a.c.*, central row of archesporial cells; *l.a.*, lateral row of ditto; *t.*, tapetum; *e.*, epidermis.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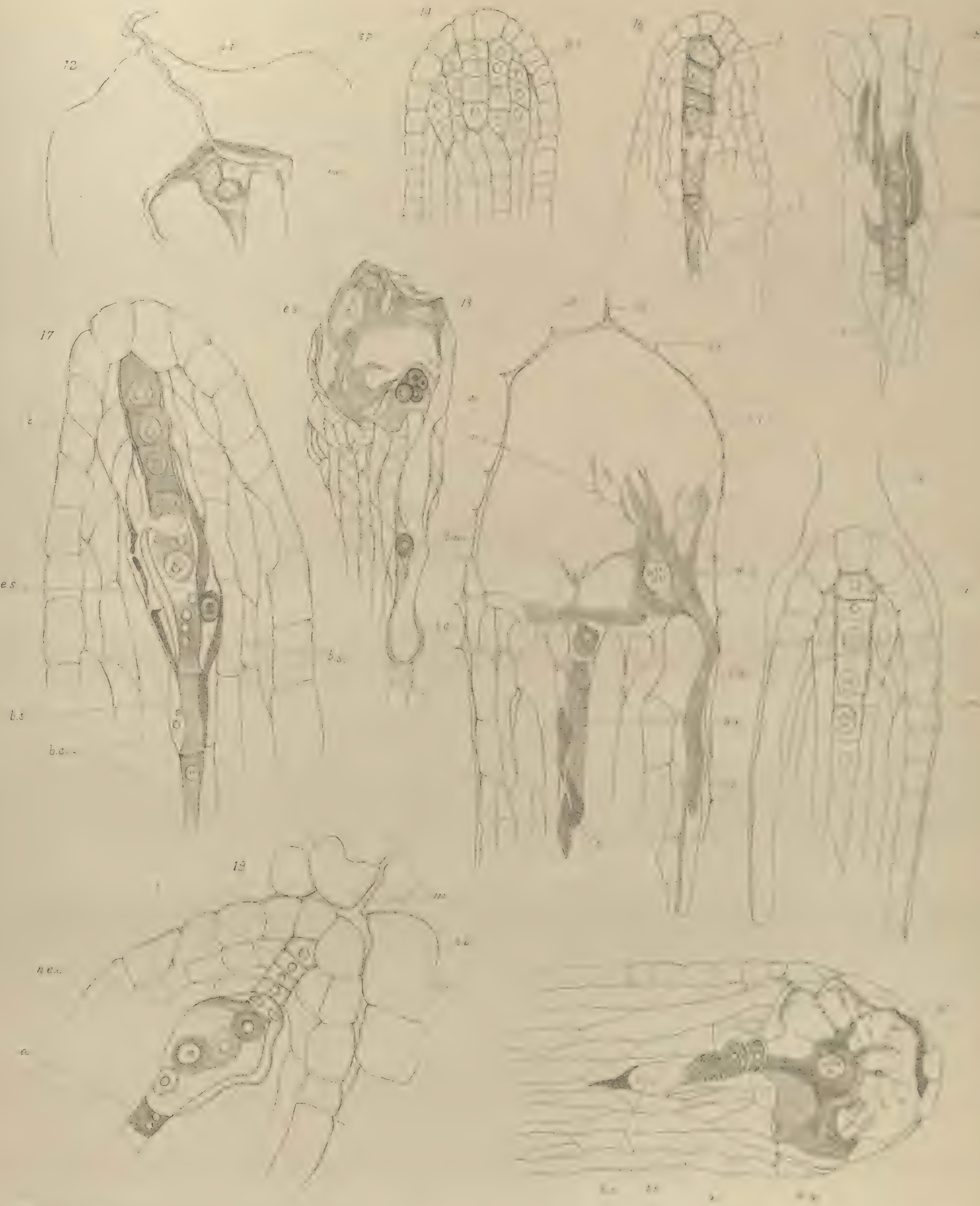
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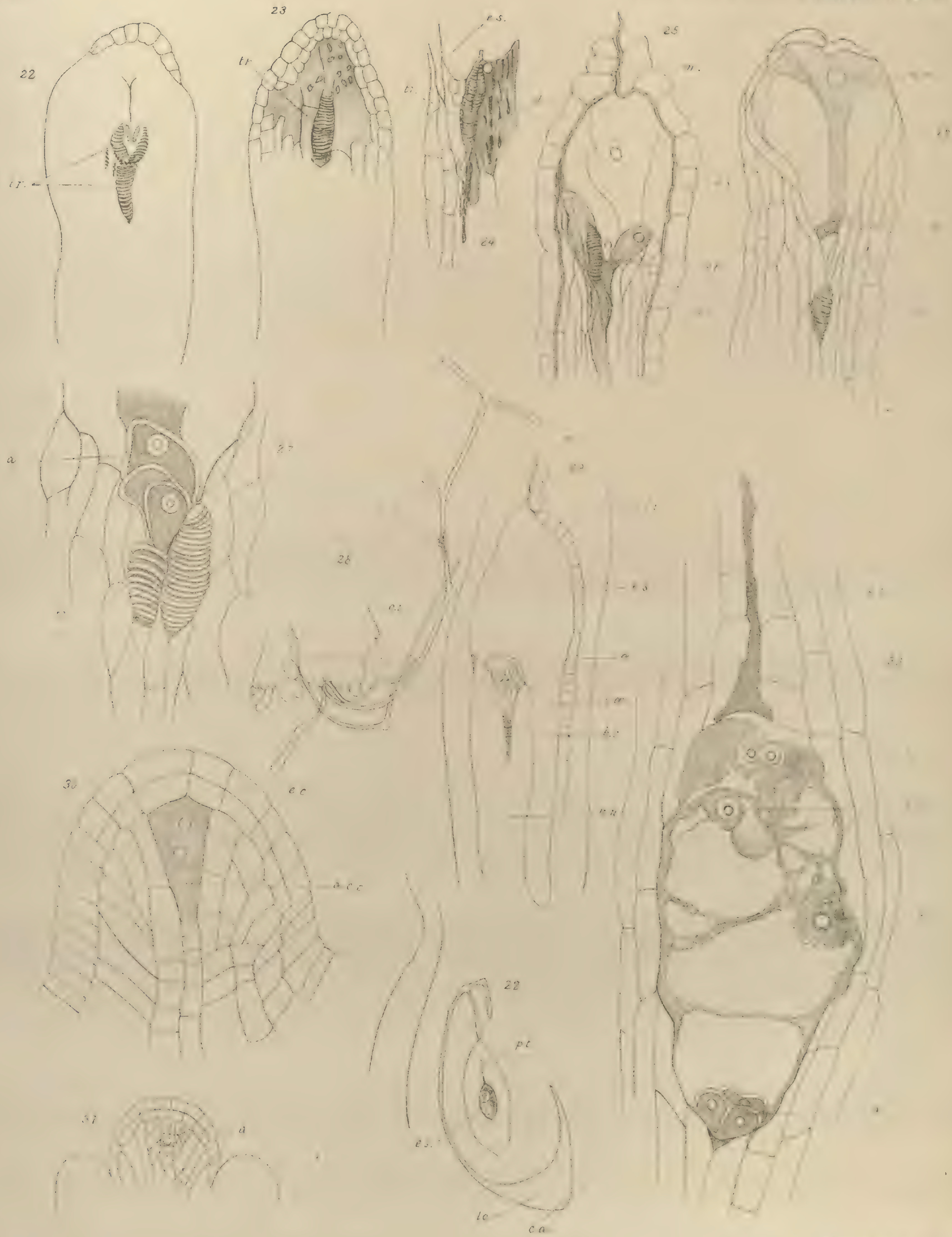
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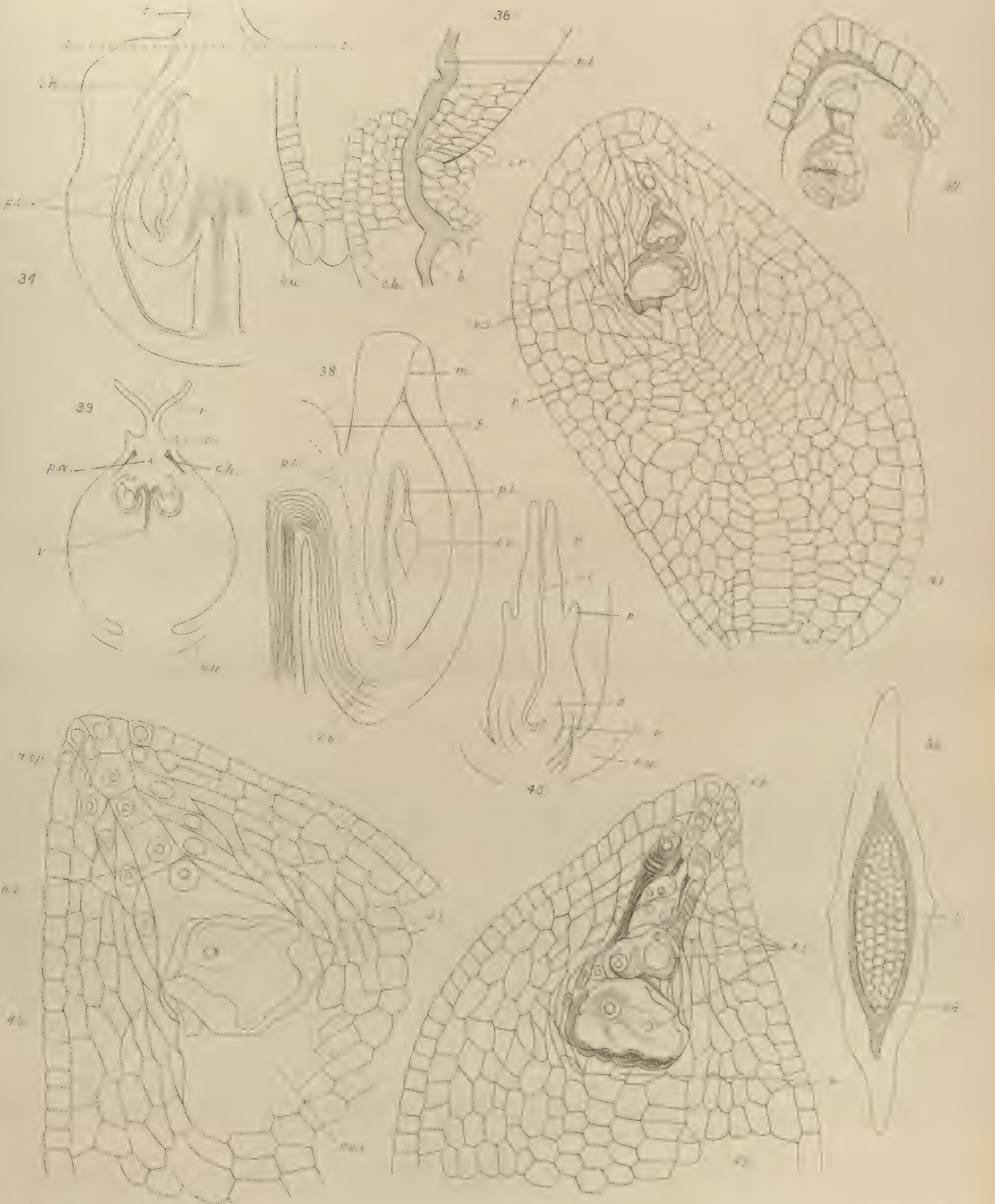
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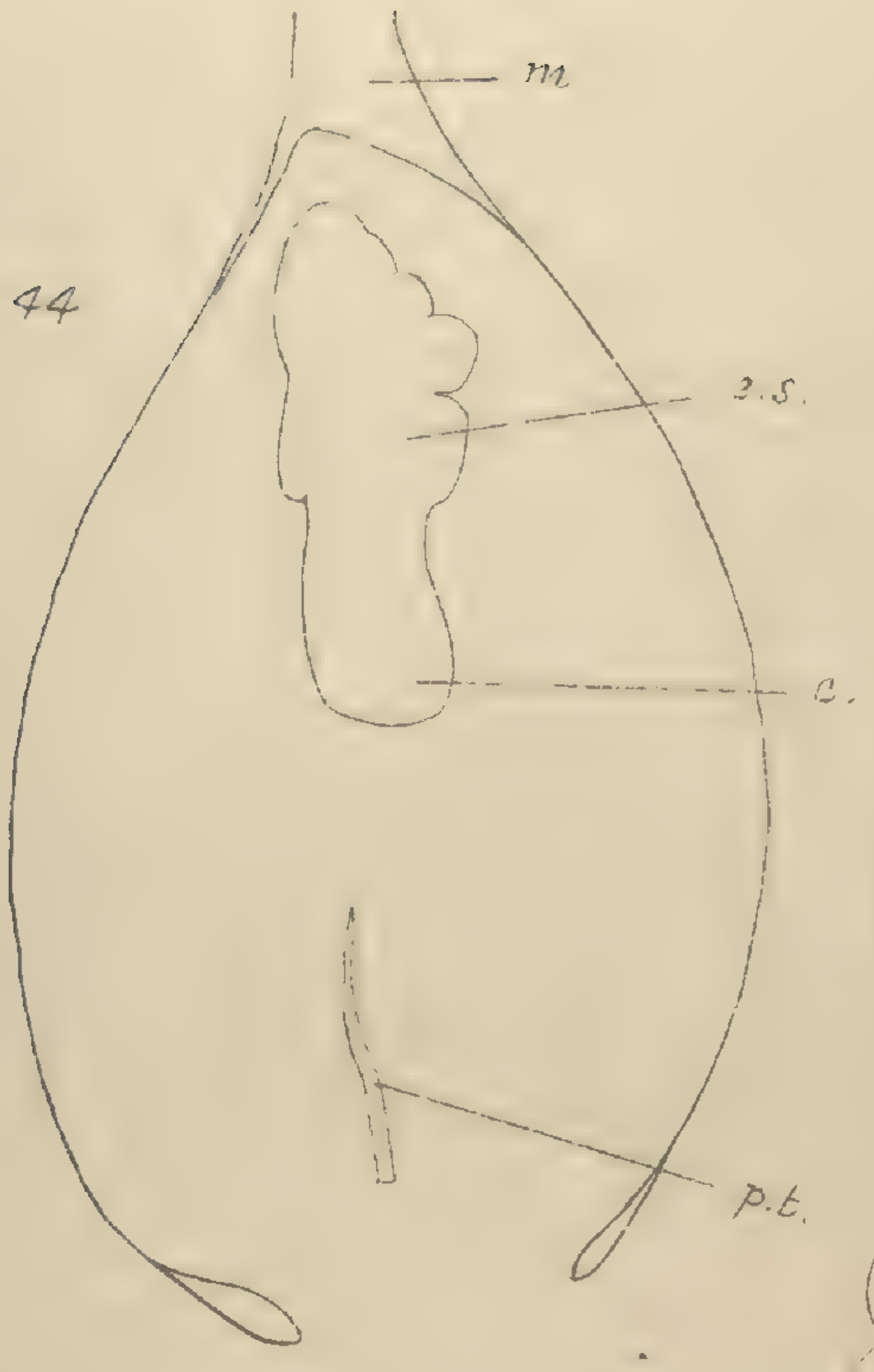

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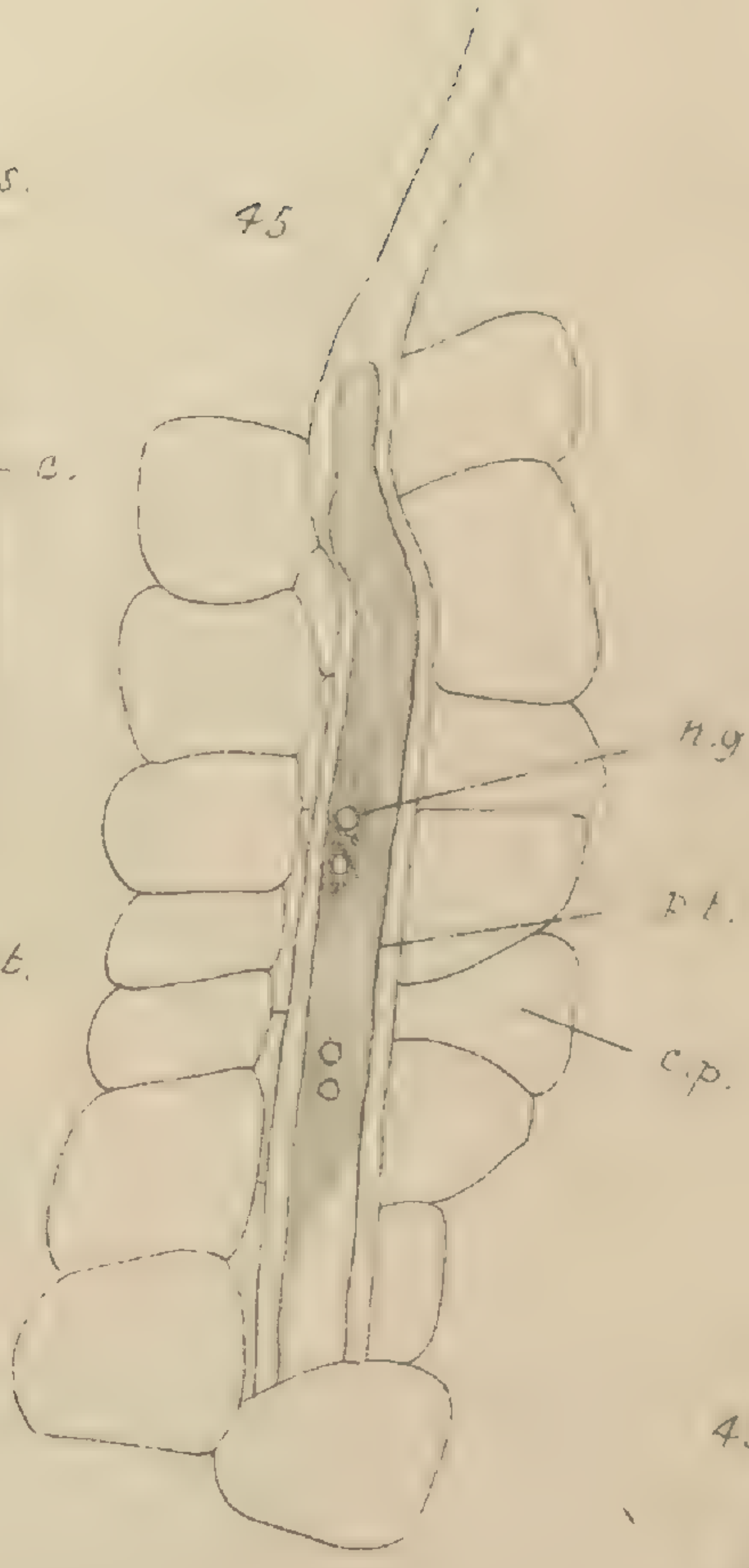

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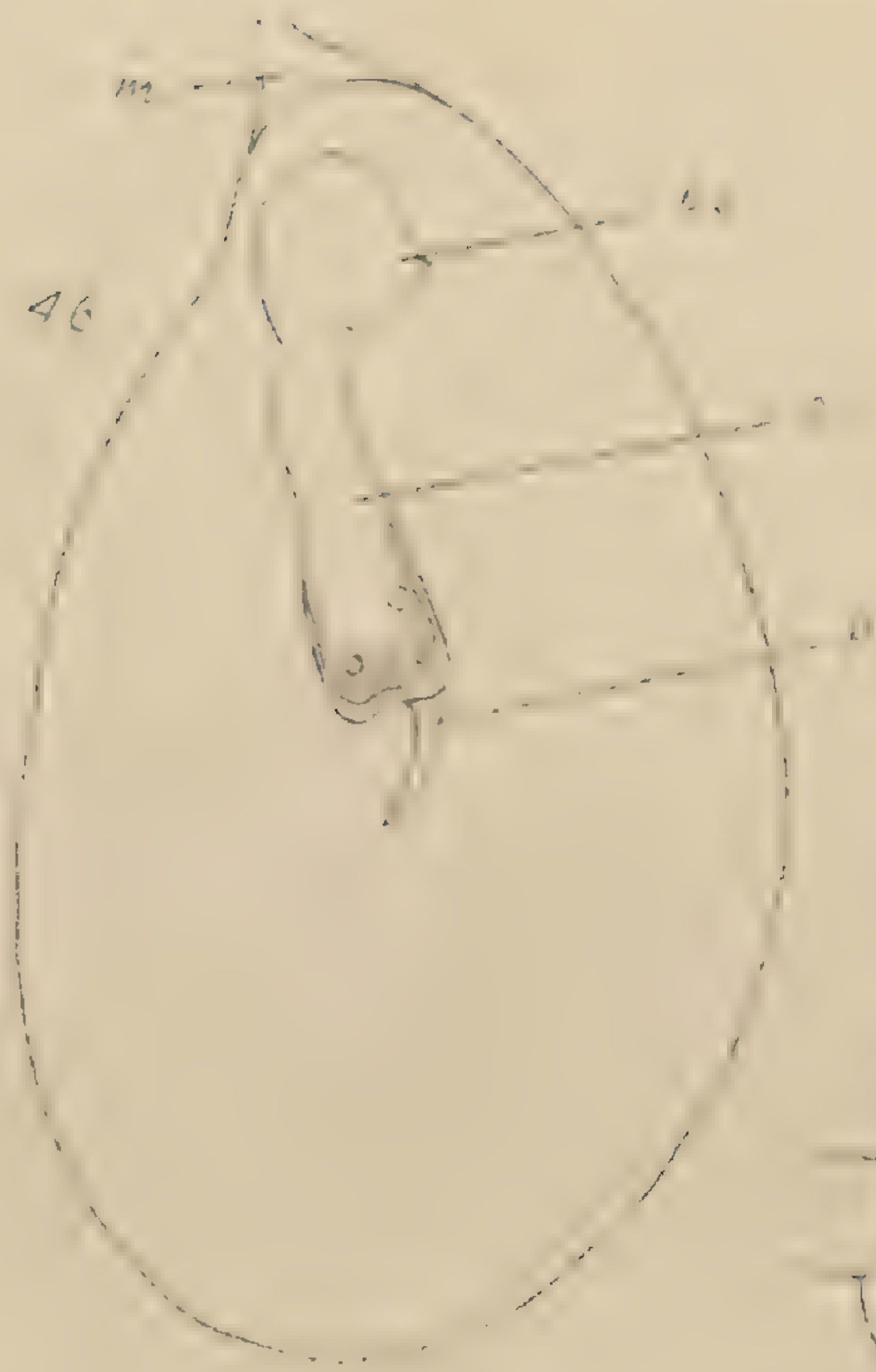

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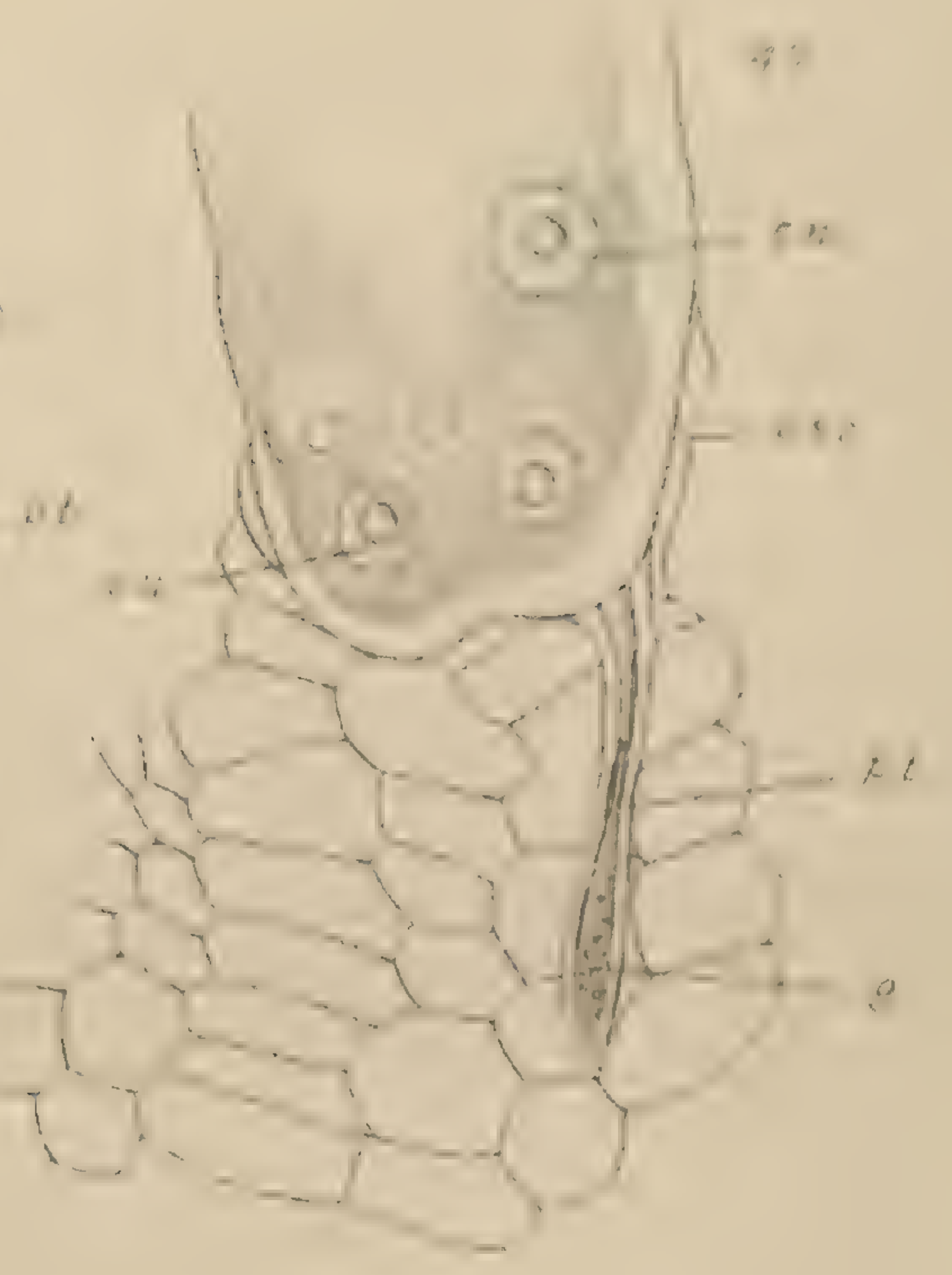

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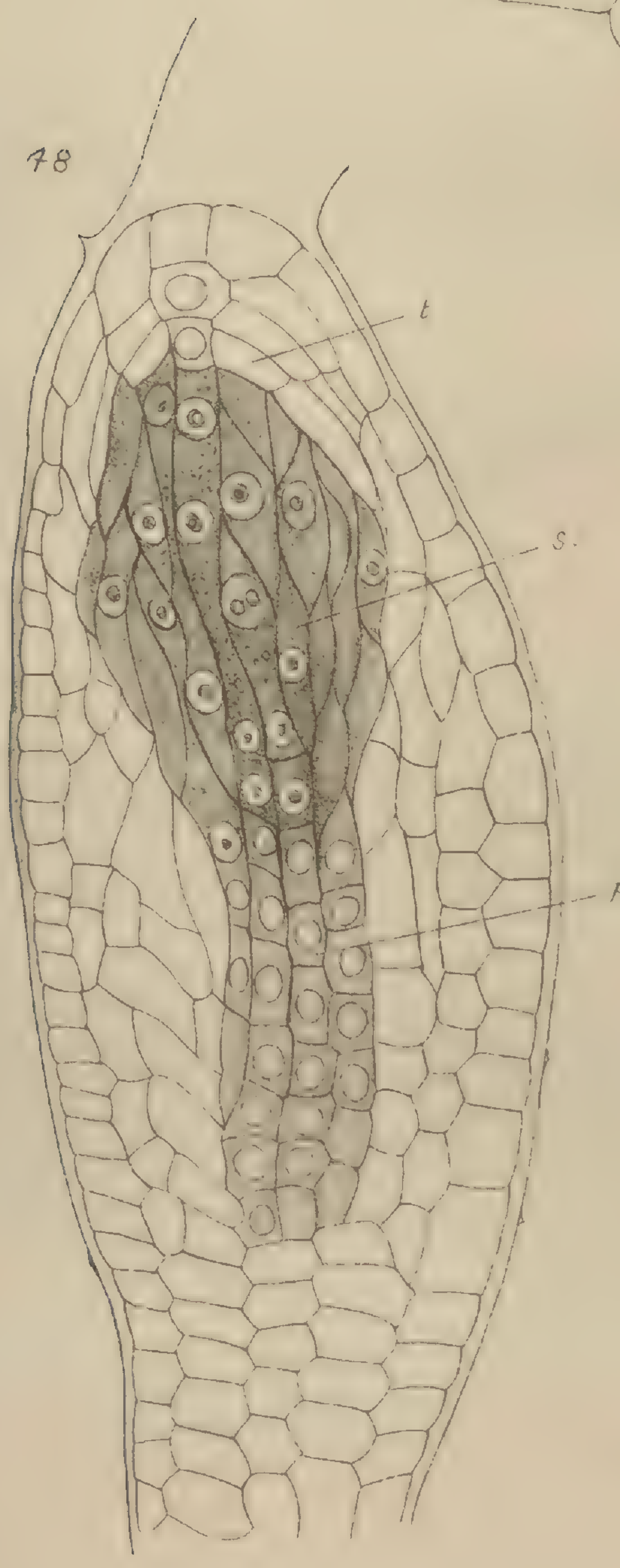

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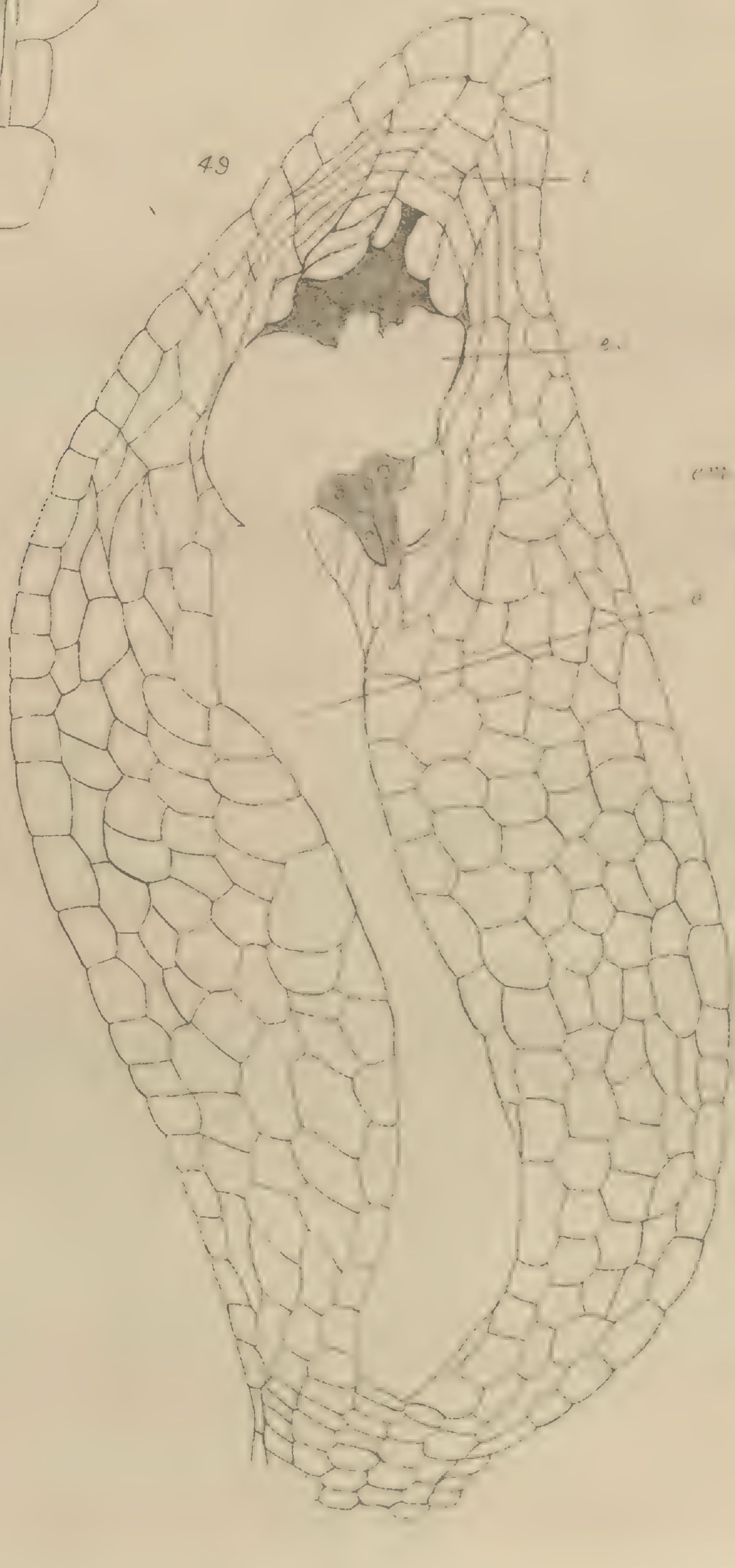

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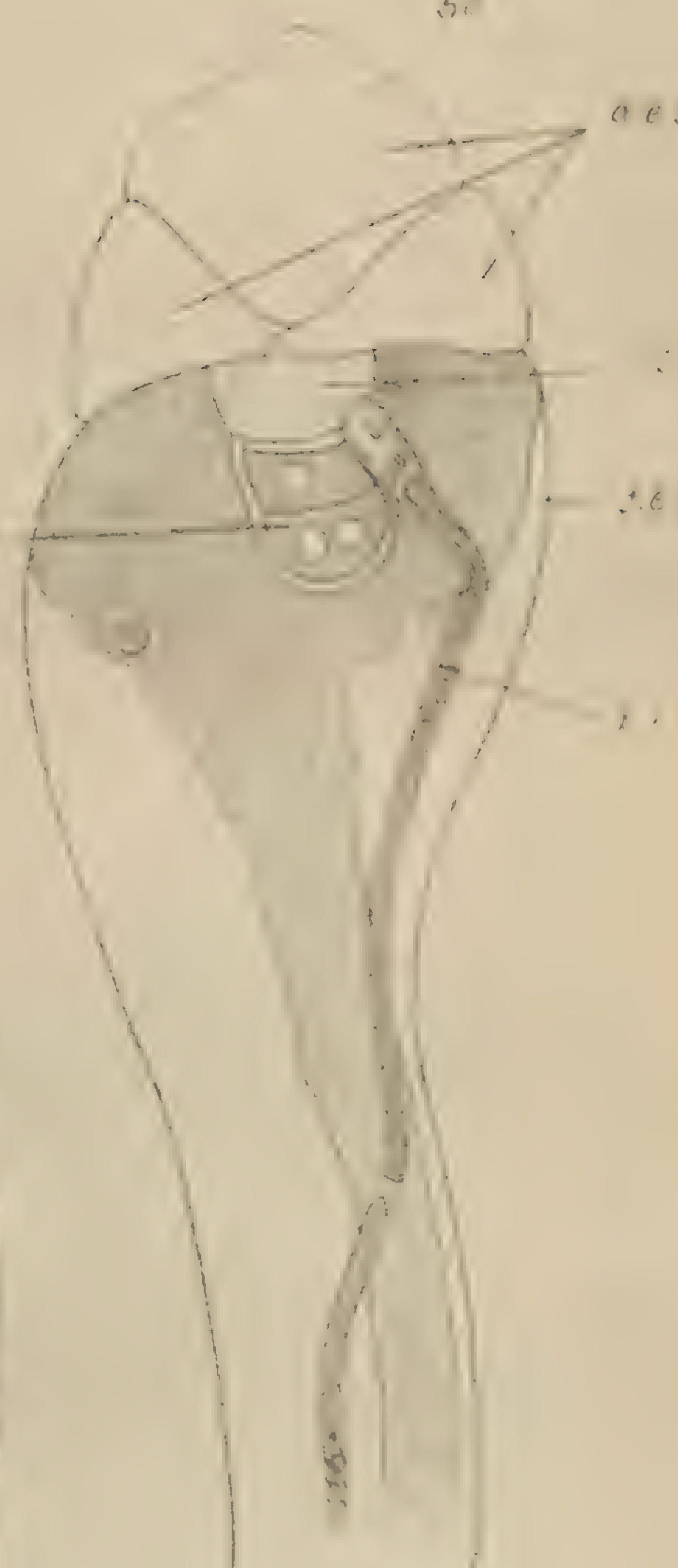

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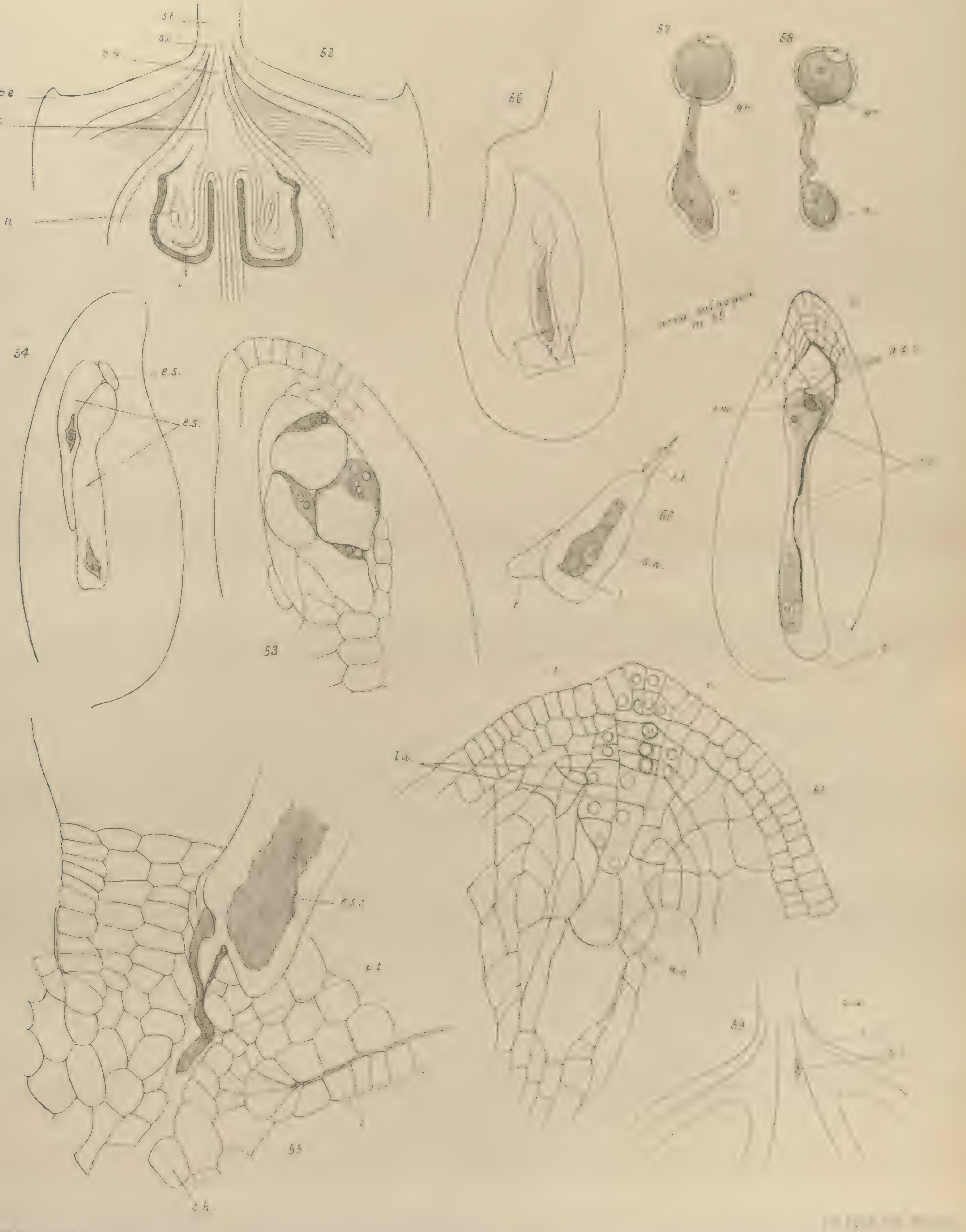
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EMBRYOLOGY OF THE AMENTIFERAE.

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	Part IV.	1882.	0	7	6	0	5	6
	Part V.	1882.	0	3	0	0	2	3
	Part VI.	1883.	1	0	0	0	15	0
	Part VII.	1883.	0	5	0	0	3	9
	Part VIII.	1883.	0	3	0	0	2	3
	Part IX.	1883.	0	3	0	0	2	3
	Part X.	1884.	0	4	6	0	3	6
	Part XI.	1884.	0	10	0	0	7	6
	Part XII.	1885.	0	6	0	0	4	6
	Part XIII.	1884.	0	6	0	0	4	6
	Part XIV.	1885.	0	6	0	0	4	6
	Part XV.	1885.	0	4	6	0	3	6
	Part XVI.	1885.	0	5	0	0	3	9
	Part XVII.	1886.	0	3	0	0	2	3
	Part XVIII.	1888.	0	2	6	0	2	0
III.	Part I.	1884.	1	14	0	1	5	6
	Part II.	1884.	1	12	0	1	4	0
	Part III.	1885.	1	10	0	1	2	6
	Part IV.	1885.	0	8	0	0	6	0
	Part V.	1887.	0	8	0	0	6	0
	Part VI.	1888.	0	6	0	0	4	6
IV.	Part I.	1886.	1	4	0	0	18	0
	Part II.	1887.	1	8	0	1	1	0
	Part III.	1888.	0	16	0	0	12	0
V.	Part I.	1888.	0	12	0	0	9	0
	Part II.	1888.	0	5	0	0	3	9
	Part III.	1889.	1	7	0	1	0	0
	Part IV.	1890.	0	12	0	0	9	0
	Part V.	1890.	0	6	0	0	4	6
	Part VI.	1891.	0	12	0	0	9	0
	Part VII.	1891.	0	6	0	0	4	6
	Part VIII.	1892.	0	8	0	0	6	0
	Part IX.	1892.	0	12	0	0	9	0
	Part X.	1893.	1	8	0	1	1	0
	Part XI.	1894.	0	2	6	0	2	0
VI.	Part I.	1894.	2	0	0	1	10	0

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	Part VI.	1884.	0	13	6	0	10	0
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	Part XV.	1887.	0	10	0	0	7	6
	Part XVI.	1888.	0	2	6	0	2	0
III.	Part I.	1888.	3	12	0	2	14	0
	Part II.	1891.	0	5	0	0	3	9
	Part III.	1891.	0	7	0	0	5	0
	Part IV.	1891.	0	6	0	0	4	6
	Part V.	1891.	0	6	0	0	4	6
	Part VI.	1891.	0	3	6	0	2	8
	Part VII.	1892.	0	6	0	0	4	6
	Part VIII.	1893.	0	6	0	0	4	6
	Part IX.	1893.	1	8	0	1	1	0
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	Part VIII.	1880.	1	1	0	0	16	0
	Part IX.	1880.	1	0	0	0	15	0
II.	Part I.	1881.	0	12	0	0	9	0
	Part II.	1882.	0	5	0	0	3	9
	Part III.	1883.	0	10	0	0	7	6
	Part IV.	1883.	0	3	0	0	2	3
	Part V.	1883.	0	3	0	0	2	3
	Part VI.	1884.	0	13	6	0	10	0
	Part VII.	1884.	0	9	6	0	7	0
	Part VIII.	1884.	0	10	0	0	7	6
	Part IX.	1886.	0	7	0	0	5	0
	Part X.	1887.	0	3	4	0	2	6
	Part XI.	1886.	0	6	0	0	4	6
	Part XII.	1886.	0	8	0	0	6	0
	Part XIII.	1887.	1	7	0	1	0	0
	Part XIV.	1887.	0	7	0	0	5	0
	Part XV.	1887.	0	10	0	0	7	6
	Part XVI.	1888.	0	2	6	0	2	0
III.	Part I.	1888.	3	12	0	2	14	0
	Part II.	1891.	0	5	0	0	3	9
	Part III.	1891.	0	7	0	0	5	0
	Part IV.	1891.	0	6	0	0	4	6
	Part V.	1891.	0	6	0	0	4	6
	Part VI.	1891.	0	3	6	0	2	8
	Part VII.	1892.	0	6	0	0	4	6
	Part VIII.	1893.	0	6	0	0	4	6
	Part IX.	1893.	1	8	0	1	1	0
	Part X.	1894.	0	10	0	0	7	6
	Part XI.	1894.	0	3	4	0	2	6